VAMP 150

Motor protection relay

Operation and configuration instructions

Technical description

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1. General

This part of the manual describes the general functions of the motor protection relay VAMP 150 and includes the relay operation instructions. It also includes instructions on parameterization and configuration of the relay and instructions on changing of settings.

The second part of the publication includes detailed protection function descriptions as well as application examples and technical data sheets.

The Mounting and Operation Instructions are published in a separate publication, code named VMMC.EN0xx.

1.1. Relay features

The motor protection relay VAMP 150 is a non-directional current measuring protection relay for internal short-circuit, internal earth-fault, unbalance, single phasing, overload and too frequent starting protection. It features the following protection functions.

- Thermal overload stage
- Three overcurrent stages
- Two earth-fault stages
- One undercurrent stage
- Phase unbalance stage
- Current unbalance stage
- Frequent starts supervision
- Start-up supervision and stall protection
- Circuit breaker failure protection

Further the relay includes a disturbance recorder and is optionally available with an arc supervision unit. It is also equipped with a current measuring transducer, the output signal of which can be wired to an external meter or a SCADA system.

The relay communicates with other systems using common protocols, such as the ModBus RTU, ModBus TCP, Profibus DP, IEC 60870-5-103 and it can be connected to the fibre-optic SPA bus.

1.2. Operating safety

The terminals on the rear panel of the relay may carry dangerous voltages, although the auxiliary voltage is switched off. An alive current transformer secondary circuit must not be opened.

Disconnecting a live circuit may cause dangerous voltages! Any operational measure must be carried out according to national and local handling directives and instructions.

Carefully read through the relay operation instructions before any relay operational measures are carried out.

2. User interface

2.1. General

The VAMP 150 relay can be controlled in three ways:

- Locally with the push-buttons on the relay front panel
- Locally with a PC connected to the serial port on the relay front panel
- Via remote control over the remote control port on the relay rear panel.

2.2. Local panel

Figure 2.2-1 below shows the location of the components of the local user interface on the front panel of the relay.

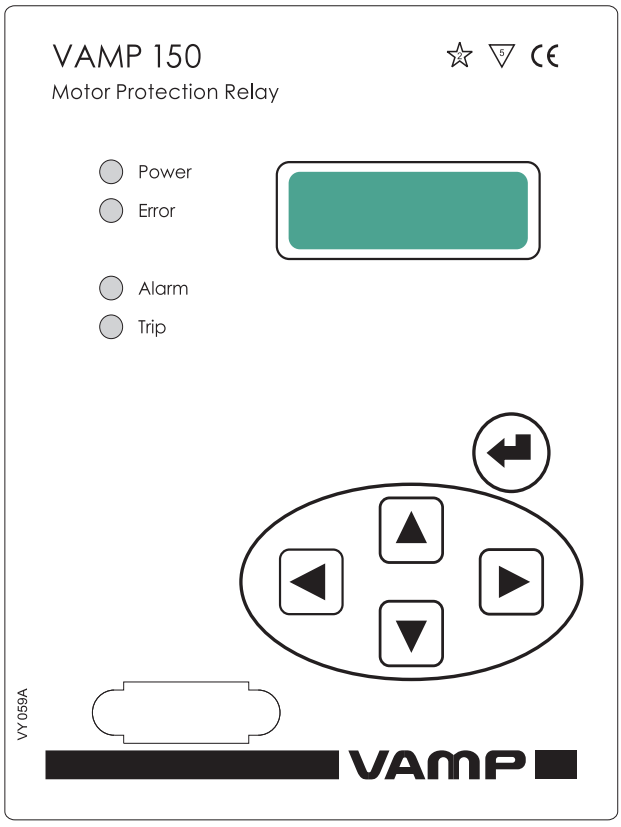

Figure 2.2-1 Relay front panel.

1. Alpha-numerical LED display
2. Key pad
3. LED indicators
4. RS 232 serial communication port for a PC

2.2.1. Display

The VAMP 150 relay is provided with a clear 10 character alphanumerical LED display, which normally shows a scrolling text.

Use the SERVICE/Setup/Bright menu to set the brightness of the display. The display is dimmed after a preset time.

Use the SERVICE/Setup/ScrolDelay menu to set the scrolling speed of the display text.

2.2.2. Key pad

Use the key pad and the display to navigate through the menus and to set the required parameters. The keypad comprises the following keys:

LEFT, RIGHT, UP, DOWN and the ENTER key.

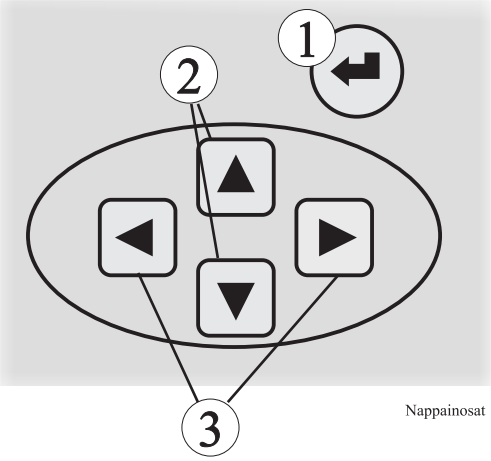

Figure 2.2.2-1 Components of the key pad.

1. Enter and confirmation key (ENTER)
2. UP/DOWN [INCREASE/DECREASE] arrow keys (UP/DOWN)
3. LEFT/RIGHT arrow keys [for selection of digit position] (LEFT/RIGHT)

Key functions

Function:	Key:	Note:
Navigation downwards in the menu. Decreasing of setting value/selection of text value in the setting state	DOWN	
Navigation upwards in the menu. Increasing of number value/selection of text value in the setting state	UP	
Moving to the right in the menu (to submenu, to parameter). Moving to the right in an adjustable value, digit by digit	RIGHT	
Moving to the left in the menu (to submenu / main menu). Moving to the left in an adjustable value, digit by digit	LEFT	
Cancellation of change	LEFT	push > 2 s
Transfer of parameter into the setting state. Activation of password supply and acceptance of password while moving to the setting state. Saving of setting and exit from setting state. Resetting of alarm display in normal operating state (USER level).	ENTER	
Resetting of (LED) indicators	ENTER	

2.2.3. Indicators

The relay front panel holds 4 LED indicators:

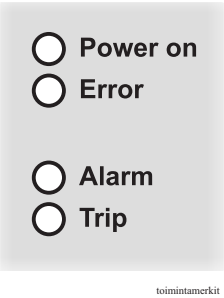

Figure 2.2.3-1 Relay operation indicators.

Relay operation indicators:

Power on	auxiliary voltage switched on
Error	self-supervision fault, the self-supervision output relay operates in parallel with the indicator
Alarm	starting of protection stage
Trip	tripping of protection stage

3. Communication via local panel

The local panel can be used to read measured values, set parameters and configure relay functions. However, please note that some of the parameters can only be set by means of a PC connected to the local communication port. Further, some parameters are factory set.

3.1. Navigation in the menus

All setting, resetting, etc. functions are carried out via menu functions, see Figure 3.1-1:

1. Use UP and DOWN arrow keys to move up and down in the main menu. The active menu is the one seen in the display. The menu names are shown with their full length or abbreviated, e.g. IL STATUS = status display for the different current stages.
2. Use the RIGHT key to move to the function level of the required menu, e.g. I> Stat.
   Use the LEFT key to cancel the selection.
3. Use the RIGHT key to move to the parameter level of the selected function, e.g. SCntr.
   Use the UP and DOWN keys to scroll through the other parameters on the same function level.
4. Confirm the selection of setting state of the requested parameter by pushing ENTER and by entering the password corresponding to the setting level.
5. Push LEFT for at least 2 s to exit from the setting state of a parameter without changing the setting value or,
6. Push ENTER to confirm and store the parameter setting.

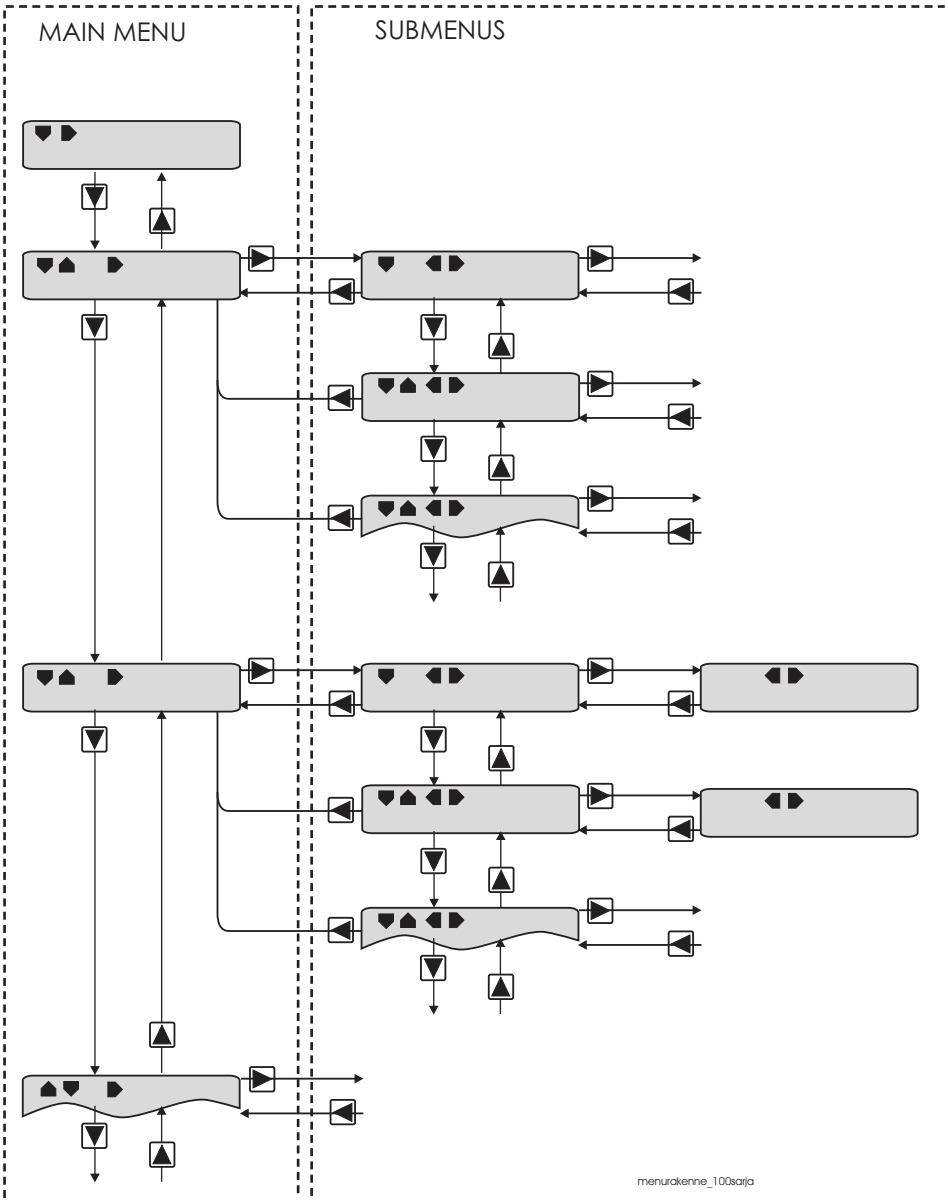

Figure 3.1-1 The principle of the menu structure and navigation in the menus.

3.2. Function menu quick reference

The structure of the menu is clear and straightforward. The main menu holds nineteen submenus, each with varying numbers of submenus and parameters.

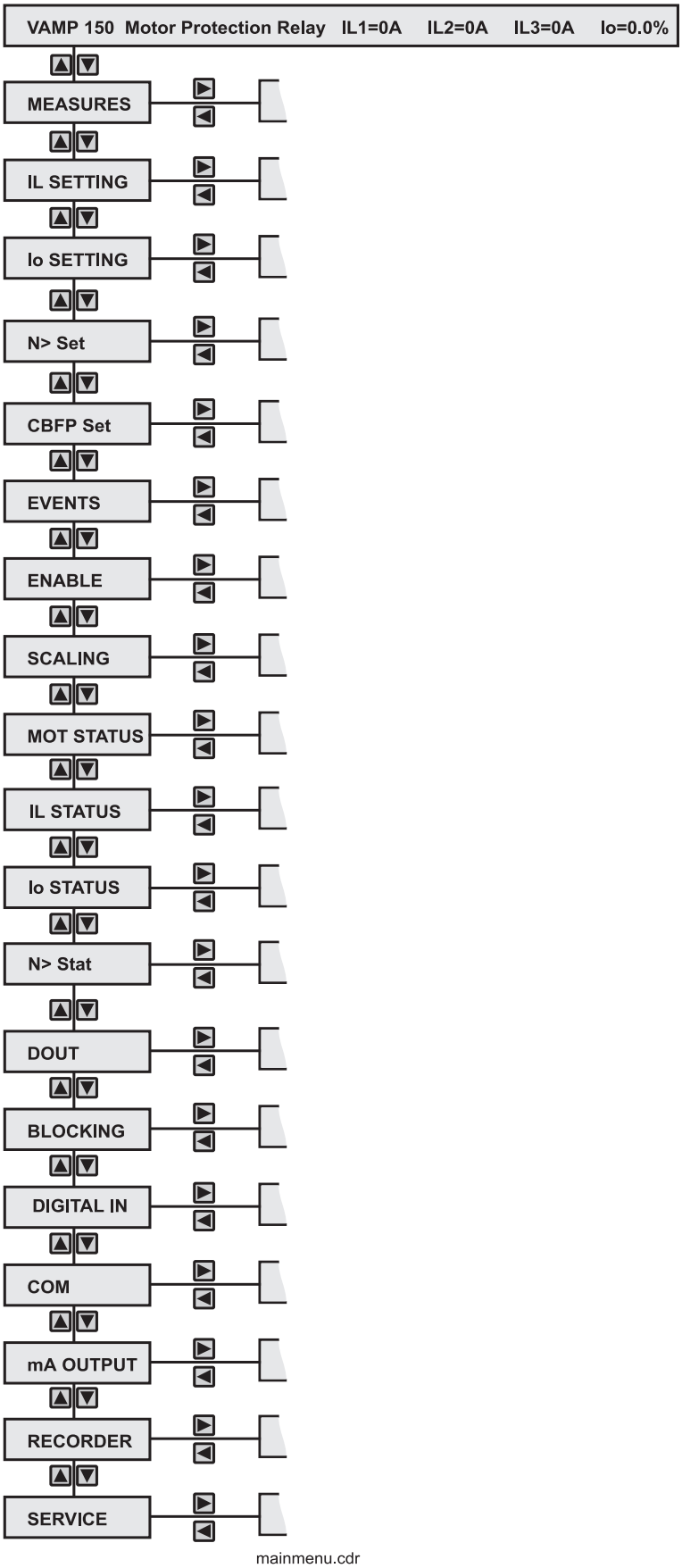

Figure 3.2-1 Main menu of the VAMP 150 relay.

3.2.1. Basic menu structure of protection functions

Example I>:

IL SETTING / I> SET:

I>	110A	Set value of protection function [A]
I>	1.10xImot	Set value of protection function [pu]
Type	DT	Selection of delay time curve (DT, NI, VI, EI, LTI)
t>	0.30s	

IL STATUS I> stat:

SCntr	-	Start counter
TCntr	-	Trip counter
Force	-	Enabling and disabling force function (ON/OFF)
Status	-	-, Start, Trip

3.3. Operating levels

The relay features three operating levels, i.e. the User, the Operator and the Configuration level. The purpose of the operating levels is to prevent accidental change of relay configurations, parameterizations or settings.

USER level

Use: Parameter values, for example, can be read

Opening: Level permanently open

Closing: Closing not possible

OPERATOR level

Use: Settings of protection stages, for example, can be changed.

Opening: The default password is 0001.

Setting state: On entering the parameter setting state the relay asks for a password "GIVE Operator password", then push the key and enter the password. Then push the key again.

Closing: The level is automatically closed 10 minutes after a key being pushed last or a setting being performed via the local port. Closing can also be performed by giving the password 9999.

CONFIGURATION level

Use:	The configuration level is needed during the commissioning of the relay. The turns ratios of the current transformers, for example, can be set.
Opening:	The default password is 0002
Configure state:	On entering the configuration state the relay asks for a password "GIVE Operator password", then push the key and enter the password. Then push the key again.
Closing:	The level is automatically closed 10 minutes after a key being pushed last or a setting being performed via the local port. Closing can also be performed by giving the password 9999.

3.3.1. Opening operating levels

1. Move to the item to be changed, e.g. IL SETTING/I>Set/ I>: 1.20 pu. Push the ENTER key twice on the front panel.

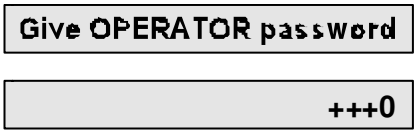

Figure 3.3.1-1 Opening an operating level

2. Enter the password needed for the desired level: The password may contain four digits. The digits are supplied one by one by first moving to the position of the digit using the RIGHT key and then setting the desired digit value using the UP key.
3. Push ENTER.

3.3.2. Changing of passwords

The set password can only be changed locally using a PC connected to the local RS 232 port on the relay. The change is allowed/prohibited with the parameter
ChgPwd = 0/1 in the SERVICE/Setup menu.

4. Operating measures

General

Carefully study the operating instructions in Chapters 1 through 3 of this manual before any operating measures are taken or before any relay settings or functions are changed.

The relay can be controlled by means of the MMI on the relay front panel, a PC running the VAMPSET software, a PC running suitable terminal software or a remote control system.

4.1. Operation via the local MMI

4.1.1. Measured data

The measured values can be read from the MEASURES menu and its submenus shown in the figure below.

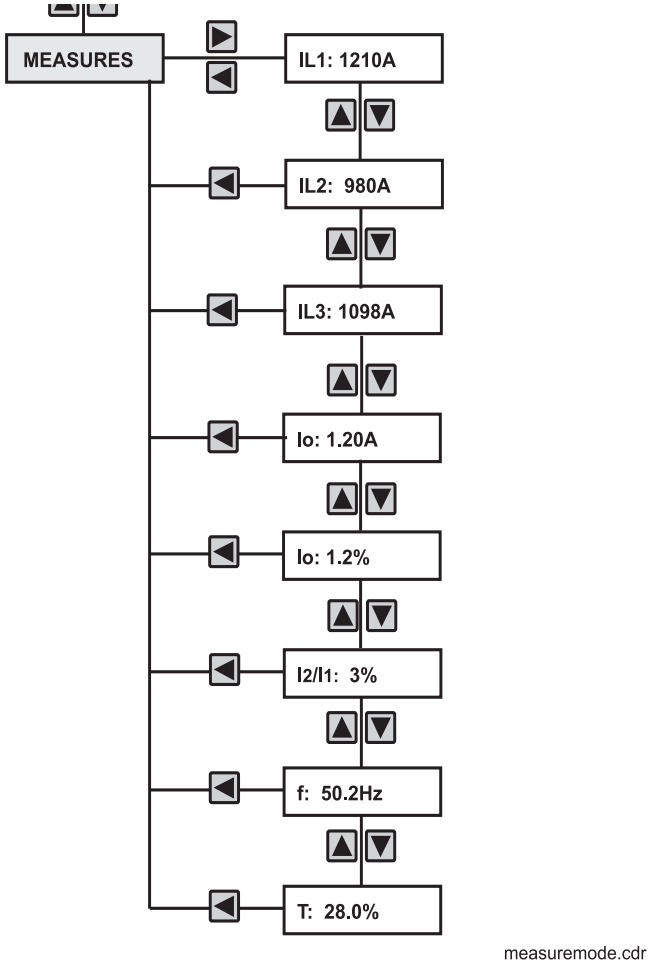

Figure 4.1.1-1 Measures menu of VAMP 150 relay.

4.1.2. Operation indicators

LED indicators	Explanation	Measure/ remarks
Power LED lit	The auxiliary power switched on	Normal operating state
Error LED lit	An internal relay fault has been detected	The relay attempts to reboot. [REBOOT]. If the error LED remains lit, call for maintenance
Alarm LED lit	One or several signals of the output relay matrix have been assigned to output Alarm and the output has been activated by one of the signals. (see Chapter 5.5)	The LED is switched off, when the signal that caused output Alarm to activate, e.g. the START signal, resets. The resetting depends on the type of configuration; Connected or Latched.
TRIP LED lit	One or several signals of the output relay matrix have been assigned to output Trip and the output has been activated by one of the signals. (see Chapter 5.5)	The LED is switched off, when the signal that caused output Trip to activate, e.g. the TRIP signal, resets. The resetting depends on the type of configuration; Connected or Latched.

Resetting latched indicators and output relays

The alarm LED and relays (Alarm) as well as the trip LED and relays (Trip) are reset in the following way:

1. Push the ENTER key to reset all latched devices.

Note:

The internal fault (IF) indication cannot be reset.

4.1.3. Reading of event register

The event register can be read from the Events item of the main menu:

1. Push the RIGHT key once, the displays shows the Event info text
2. Push the RIGHT key once, the displays shows Count: x, where x = the number of recorded events
3. Push the DOWN key once, the display shows the ClrEv text. The event register can now be reset.
4. Push the LEFT key to return to the Event info menu (by pressing twice you can return to the main menu)
5. Push the DOWN key to return to the Event list menu:

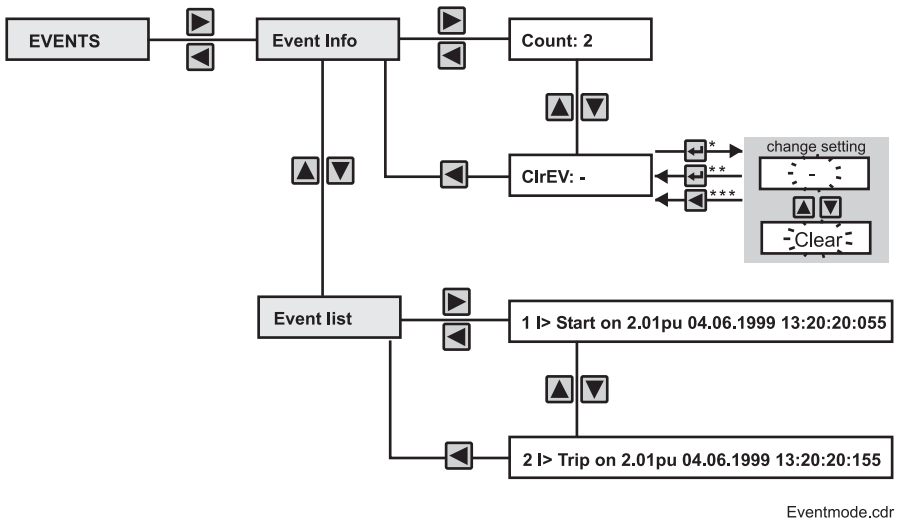

Figure 4.1.3-1 Event register, example.

6. Push the RIGHT key once to enter the event list, the display shows the last Event list text. Scroll the event list by pushing the UP and DOWN keys.
7. Push the LEFT key twice to move from the event list to the main menu.

4.1.4. Forced control (Force)

In the SERVICE menu it is possible to use forced control of the output relays, e.g. for testing purposes.

To activate the forced control function (see Figure 4.1.4-1):

1. Move to the SERVICE level of the main menu.
2. Push the RIGHT key once to move to the submenu Relays
3. Push the RIGHT key once to move to the output relays' force setting parameter Force:

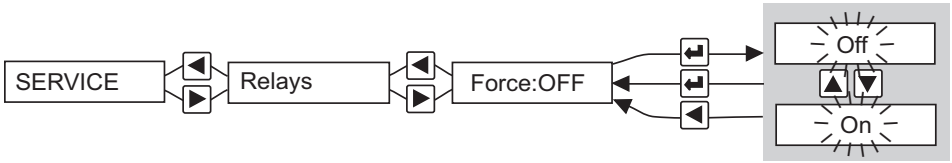

Figure 4.1.4-1 Activation of the Force function.

4. Push the ENTER key while on the Force: level to be able to change the setting (the parameter to be set is blinking)
5. Push the UP and DOWN keys to change the OFF text to the ON text in the display (Force function activated).
6. Push the ENTER key to confirm the setting and to move back to the Force: level
7. The Force: level has a selection list. Push the UP and DOWN keys to select the desired output relay, which is controlled on and off by forced control:

8. Push the ENTER key to obtain the setting state, e.g. Relays/T1.
9. Push the UP or DOWN key to change the selection 0 -> 1.
10. Push the ENTER key to perform a controlled operation of the output relay (e.g. the T1 is activated) and to return to the Force: level.
11. Push the LEFT key for more than 2 s to return from the Force: setting state to the normal Force: state without changing the control state.
12. Push the LEFT key to return from the Force: setting state to the Relays submenu.
13. Push the LEFT key to return to the main menu.

4.1.5. Setting range limits

Note!

Parameters requiring a numerical setting value can be given out-of-range settings, but when the setting is confirmed with the ENTER key, a fault message will be obtained. Adjust the setting to within the permitted setting range.

4.1.6. Adjusting display contrast and scroll speed

The readability of the LCD varies with the brightness of the surrounding. When needed the brightness can be adjusted in the SERVICE/Setup/Bright: menu.

The scroll speed of the text in the display can be adjusted in the SERVICE/Setup/ScrolDelay: menu.

4.1.7. Setting date and time

Date, time and style is set in the SERVICE/Setup/Date, Time and Style menus.

5. Configuration and setting of parameters

User level: CONFIGURATION

- Choose the protection functions in the ENABLE position of the main menu, see chapter 5.2. NOTE! Protection functions not enabled will not be shown in the submenus.
- Change the parameters of overcurrent, stall protection, overload, unbalance, phase sequence, undercurrent and arc protection functions in the IL SETTING position of the main menu, see chapter 5.3.
- Change the parameters of residual current and residual arc protection functions in the Io SETTING position of the main menu, see chapter 5.3.
- Change the parameters of the frequent start protection function in the N> Set position of the main menu, see chapter 5.3.
- Change the parameters of Circuit Breaker Failure Protection function in the CBFP Set position of the main menu, see chapter 5.3.
- Set the current transformer scaling and residual current scaling (e.g. Imot, CTprim, CTsec, CToprim, etc.) in the SCALING position of the main menu, see chapter 5.4.
- Configure the digital outputs in the DOUT position of the main menu, see chapter 5.5.
- Configure the interlockings in the BLOCKING position of the main menu, see chapter 5.6.
- Configure the digital input in the DIGITAL IN position of the main menu, see chapter 5.7.
- Choose and configure the communication buses in the COM position of the main menu, see chapter 5.8.
- Configure the analog output in the mA OUTPUT position of the main menu, see chapter 5.9.
- Change the parameters of the Disturbance recorder in the RECORDER position of the main menu.
- Set the Date and time in the SERVICE position of the main menu, see chapter 5.10.

NOTE!

Some of the parameters, for instance the password, can only be altered via the RS 232 serial communication port using a PC.

5.1. Principle of parameter setting

This example shows how to change the scaling of the current transformers. Same principle is used to change other parameters, see Figure 5.1-1.

1. Use the DOWN key of the front panel to move to item SCALING of the main menu.
2. Use the RIGHT key to move one step to the right, the text CTprim: 100 A appears in the display. Use the DOWN key to select the CTsec.
3. Use the ENTER key twice to move to give the operator password. Use the ENTER key to confirm the password.
4. Use the UP and DOWN key to change the setting value and use the RIGHT and LEFT key to move from digit to digit.
5. Use the ENTER key to confirm the function or push the LEFT key for >2 s to cancel the function.
6. Push the LEFT key twice to return to the main menu.

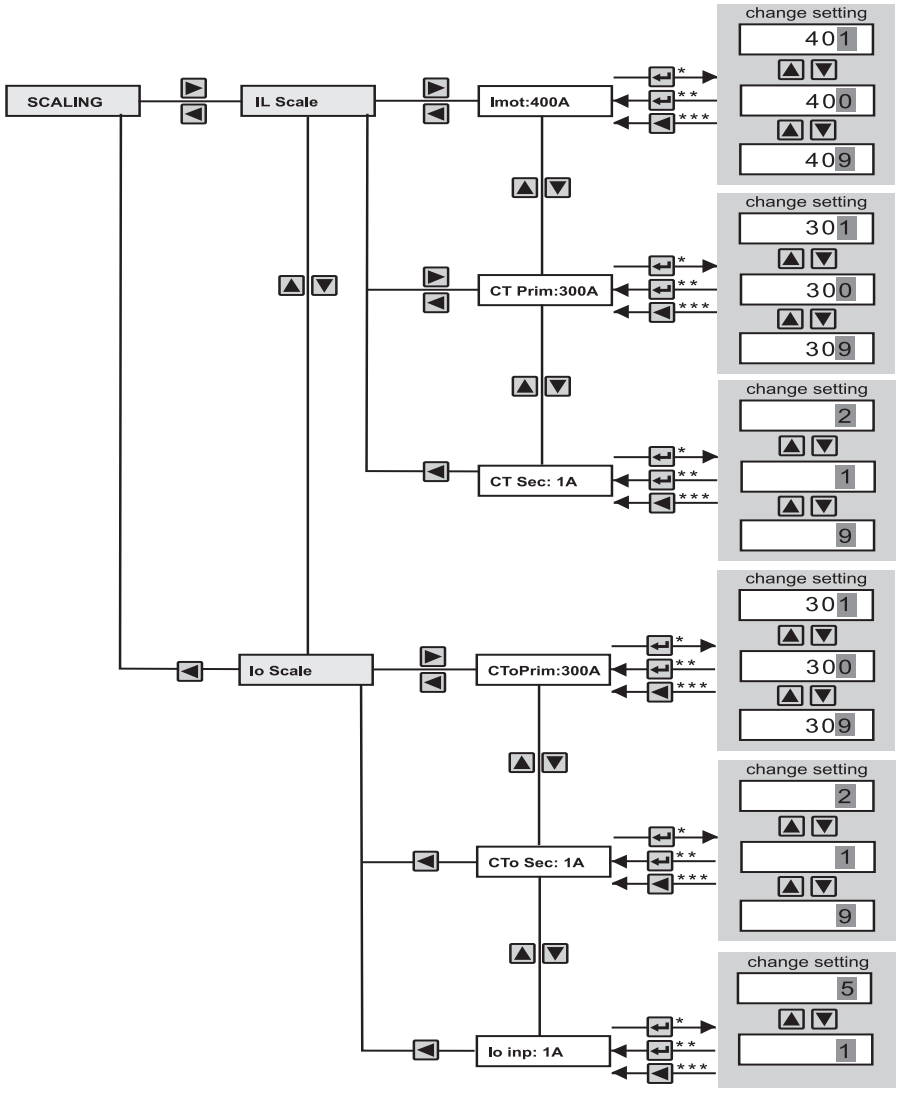

Figure 5.1-1 Changing parameters.

5.2. Enabling and disabling protection functions (ENABLE)

Via the submenus of the ENABLE menu, all the protection functions can be enabled (ON) or disabled (OFF):

ENABLE I

- Overcurrent, stall protection, unbalance, phase sequence, overload, undercurrent and arc protection stages (I> I>>, I>>>, Ist>, I_2>, I_2>>, T>, I< and ArcI>)

ENABLE Io

- Residual current stages and residual arc protection (Io>, Io>>, and ArcIo>)

Ena CBFP

- Circuit Breaker Failure Protection stage (CBFP)

Ena N>

- Frequent start protection (N>)

RESET

- Reset the software of the VAMP 150 relay and reset latches (Reset and Latch)

NOTE!

Disabling a protection function will remove the item from the menu.

5.3. Setting protection function parameters

The settings of the selected protection functions can be read and set separately in the submenus of each function.

Available protection stages

- I>, I>>, I>>>, Ist>, T>, I_2>, I_2>>, I<, ArcI> (IL SETTING)
- Io>, Io>>, ArcIo> (Io SETTING)
- N> (N> Set)
- CBFP (CBFP Set)

5.4. Scaling of measuring transformers

Via the submenus of the SCALING menu the following can be read and set:

SCALING/IL Scale

- Motor nominal current (Imot)
- Current transformer primary value (CTprim)
- Current transformer secondary value (CTsec)

SCALING/Io Scale

- Residual current transformer primary value (CToprim)
- Residual current transformer secondary value (CTosec)
- Residual current input channel 1A or 5A (Ioinp)

5.5. Configuring digital outputs DOUT

Via the submenus of the DOUT menu the following functions can be read and set:

Configuration of the output signals to the output relays T1 and T2, A1 – A3 and the operation indicators (LED) Alarm and Trip, that is, the output relay matrix.

5.6. Configuring blocking matrix BLOCKING

Configuration of the blockings is done under the BLOCKING menu. Any start or trip signal can be used to block the operation of any wanted protection stage.

5.7. Configuring the digital input DIGITAL IN

Via the submenus of the DIGITAL IN menu the following functions can be read and set:

- Status of the digital input (DI1)
- Operation delay (D1 dly)
- Polarity of the input signal (DI1pol), either normally open (NO) or normally closed (NC) circuit.
- Remote release of latches using digital input (RemRel)
- Selection to event register (OnEvent and OffEvent)

5.8. Configuring communication protocols COM

Via the submenus of the COM menu the following functions can be read and set:

Active

- Communication protocol of REMOTE port (Protocol)
- Message counter (Msg#)
- Communication error counter (ERRORS)
- Communication time-out counter (Tout)

Profibus

- Profibus profile (Mode)
- Transfer rate of converter
- Profibus Tx Buf lentgh (InBuf)
- Profibus Rx Buf lentgh (OutBuf)

ModBus

- Device slave number at ModBus Slave Protocol
- Target slave number at ModBus Master protocol (Addr)
- ModBus transfer rate (bit/s)
- ModBus parity check (Parity)

SpaBus

- Slave number (Addr) when relay connected to SPA substation
- SPA-Bus transfer rate (bit/s)
- Event mode (Emode)

IEC-103

- Slave address (Addr)
- Transfer rate (bit/s)
- Interval for sending measurements (MeasInt)
- ASDU6 response time mode (SyncResMod)

TCP/IP (ModBus TCP, only in VAMPSET)

- IP address of the relay (IPAddr)
- Subnet mask (NetMsk)
- IP address of the Name Server
- IP address of the SNTP Server (NTPSvr)

Local Port

- Transfer rate of local serial bus (bit/s)

5.9. Analog output mA OUTPUT

Via the submenus of the mA OUTPUT menu the following functions can be read and set:

- Analog output reading / editing a forced value (AO)
- Enabling / disabling of forced control of the analog output (FORCE)
- Choosing the coupling of analog output (Link)
- Setting the coupling minimum value (Min)
- Setting the coupling maximum value (Max)
- Setting the analog output minimum value (AOmin)
- Setting the analog output maximum value (AOmax)

Available couplings to the analog output

- IL1, IL2, IL3, IL
- Io
- f
- I2/I1
- I_fault

5.10. Service menu SERVICE

Via the submenus of the Service menu the following functions can be read and set:

Relays

- Enabling / disabling of forced control of the output relays (FORCE)
- The status of the output relays (T1 and T2, A1 – A3 and IF)
- The forced control of the output relays (T1 and T2, A1 – A3 and IF)

Setup

- Setup of screen brightness (Bright)
- Setup of screen scroll delay (ScrlDelay)
- Changing of password (ChgPwd)
- Changing of date, time and date style (Date, Time, Style)

DeviceInfo

- Serial number of the device (SerN)
- Software version (Prgver)

6. PC software

6.1. PC user interface

The PC interface is intended to be used for onsite parameterization of the relay and for reading of measured values to a computer or loading of the relay software from a computer.

The RS 232 serial port is available for the connection of a local PC on the front panel of the relay. To connect a PC to the serial port use a connection cable of type VX 003-3.

6.1.1. Using the VAMPSET program

See separate user's manual for the VAMPSET software, VMV.EN0xx. If the VAMPSET software is not available please download it from www.vamp.fi.

6.2. Remote control connections

The protection relay communicates with higher-level systems, e.g. remote control systems, via the serial port (REMOTE) on the rear panel of the relay.

ModBus, SPA-Bus, IEC 60870-5-103, ProfiBus or ModBus TCP can be used as REMOTE communication protocols (see details in Chapter 2.5.2. in technical description).

Additional operation instructions for various bus types are to be found in their respective manual.

7. Commissioning configuration

7.1. Factory settings

When delivered from the factory, the relay has been given factory default settings or settings defined by the customer. The actual configuration can be read from the workshop test reports or from the final test reports

7.1.1. Configuration during commissioning

The configuration and settings of the Motor protection relay VAMP 150 is defined and checked during commissioning in accordance with the instructions given in Chapter 5 of this manual, for example in the following order:

1. Scaling of the rated values of the current transformer in menu SCALING/IL Scale
2. Scaling of the rated values of the residual current transformer SCALING/Io Scale

The scaling is done in the software block of the measured signals, Figure 7.1.1-1. Thus the scaling affects all the protection functions.

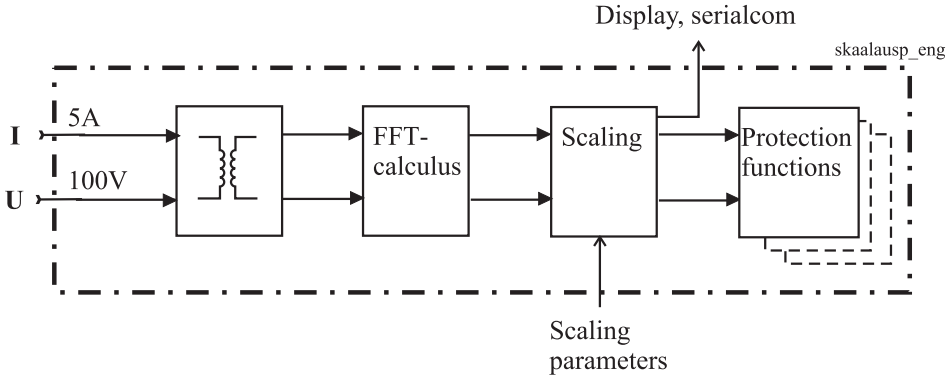

Figure 7.1.1-1 Principle for scaling the measured values of the VAMP 150 relay.

3. Activation of the desired protection functions, ENABLE menu, see Chapter 5.2.
4. Setting values of the protection functions, IL SETTING and Io SETTING menus, see Chapter 5.3.
5. Configuration of the starting and tripping signals of the protection stages to the desired output relays and the LED indicators (DOUT menu), see Chapter 5.5.
6. Configuration of the blocking matrix (BLOCKING menu), see Chapter 5.6.

7. Selection of the communication protocol and setting of the communication parameters (COM menu), see Chapter 5.8.
8. Other required parameters, for example the DI input, mA output and circuit-breaker failure protection.

7.1.2. Configuration examples

The following example illustrates the calculation and scaling of seting values and the grouping of output relays in a typical protection configuration. The numerical values given in the example are to be regarded as guidelines only.

Example:

The example is based on the technical application drawing of Chapter 3, Figure 3.1-1. in the technical description.

In the application the following functions and stages are used:

- Two-stage overcurrent protection (I>, t> and I>>, t>>)
- Stall protection Ist> (Ist>, ImotSt, Type, tDT>)
- Overload protection (T>, Alarm, Tau, Tau2, Imax40, Imax70, Tamb)
- Two-stage residual current protection (Io>, to>and Io>>, t>>)
- Frequent start protection N> (Sts/h, Interval)

The above functions are enabled via the ENABLE menu by selecting the "On" in the ENABLE menu, see Chapter 5.2. the functions not to be included are disabled by selecting the “Off” value.

1 Output data:

Give within the parenthesis are the configuration menus where the settings are done.

Transforming ratios of measurement transformers

Motor niminal current Current transformer (CT) (SCALING/IL Scale)	Imot CTprim CTsec	400 A 500 A 5 A
Residual current transformer (CTo) (SCALING/Io Scale)	CToprim CTosec Ioinp	100 A 1 A 1 A

2 Selection of setting values:

Protection stage:	Parameter:	Setting:
Overcurrent stage I>	I> Type t>	1.20xImot DT 0.50 s
Overcurrent stage I>>	I>> t>>	1.50xImot 0.20 s
Stall protection stage Ist>	Ist> ImotSt Type tDT>	1.50xImot 6.00xImot DT 2.0s
Overload stage T>	T> Alarm Tau Tau2 Imax40 Imax70 Tamb	1.06xImot 90% 60 min 1.0xTau 100%Imot 78%Imot 40°C
Residual current stage Io>	Io> t>	0.10pu 0.40 s
Residual current stage Io>>	Io>> Type t>>	0.20pu DT 0.20 s
Frequent start protection N>	Sts/h Interval	6 10.0min

3 Blocking matrix

The required blocking of the protection functions are configured in the BLOCKING menu, see Chapter 5.6.

4 Output relay configuration

The required grouping of output relays and output signals are configured in the DOUT menu, see Chapter 5.5.

In the example, relay T1 is programmed to open the circuit breaker with a trip signal (for example I>>) selected in the DOUT menu.

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1. Introduction

This part of the manual describes the protection functions, provides a few application examples and contains technical data. This part of the manual also includes the operating instructions.

Mounting and Commissioning Instructions are provided in a separate mounting and commissioning manual (VMMC.EN0xx).

1.1. Application

The versatile basic protection functions, the wide variety of additional functions and several available communication protocols render the motor protection relay VAMP 150 an ideal protection relay for circuit breaker controlled three phase asynchronous motors.

The modern technology in association with an extensive self-supervision system and a reliable construction ensures an extremely high availability for the VAMP 150 protection relay.

The relay is used for internal short circuits faults, internal earth faults, unbalance single phasing, incorrect phase sequence, overload protection and too frequent starting. The relay includes also an undercurrent function to protect the load driven by the motor e.g. a pump.

The relay is further provided with a mA output for measuring the load current. As an option the relay can be provided with an arc detection system, which in combination with the extremely fast overcurrent stage forms a fast arc protection function.

1.2. Main features

- Fully digital signal handling with a powerful 16 bit micro processor and high measuring accuracy on all setting ranges due to an accurate 12 bit A/D conversion technique.
- Easy enabling and disabling of protection functions according to the needs of the intended application.
- Wide setting ranges for the protection functions.
- Flexible external control and blocking possibilities due to the digital signal control input (DI).

- Easy adaptation of the relay to various substations and alarm systems due to a flexible signal-grouping matrix in the relay.
- Recording of events and fault values into an event register, from which data can be read via the key pad and the display or by means of the PC based VAMPSET user interface.
- Signals from the relay's mA output can be wired to an external meter or a SCADA system.
- Handy configuration, parameterization and reading of information via the user panel or by means of the PC based VAMPSET user interface.
- Easy to connect to power plant automation systems due to versatile serial connection and several available communication protocols.
- Reliable built-in self-regulating dc/dc converter for auxiliary power supply within the supply voltage range 40 - 265 V dc/ac, optionally 24 V dc.
- Built-in disturbance recorder for evaluating primary and secondary, as well as neutral currents of the protected object.

2. Functions

The individual protection functions of the VAMP 150 motor protection relay can independently of each other be enabled or disabled according to the requirements of the application. See the configuration instructions, Chapter 5 and 7, in the first part of this manual.

2.1. Principles of the numerical protection technique

The VAMP 150 relay is designed using numerical technology. This means that all signal filtering, protection and control functions are made by digital processing.

The numerical technology used in the relay is primarily based on an adapted fast Fourier-analysis (FFT), in which case the number of calculations (multiplications and additions) required to filter out the measuring quantities remains reasonable.

By using synchronized sampling of the measured signal (phase or residual current) and a sample rate according to the 2^n series, the FFT technique leads to a solution, which can be realized with just a 16 bit micro controller, without using a separate DSP (Digital Signal Processor).

The synchronized sampling means an even number of 2^n samples per period, e.g. 16 samples/period. This means that the frequency must be measured and the number of samples per period must be controlled accordingly, so that the number of samples per period remains constant should the frequency change.

Figure 2.1-1 shows the main components of a relay using numerical technology; i.e. the relay comprises input transformers, digital input adapters, output relays, A/D converters and a micro controller including memory circuits. Further the relay needs a power supply and a user interface.

Figure 2.1-2 shows the heart of the numerical technology or the main block diagram of the calculated functions.

Figure 2.1-3 shows a functional principle diagram of a single-phase overcurrent function.

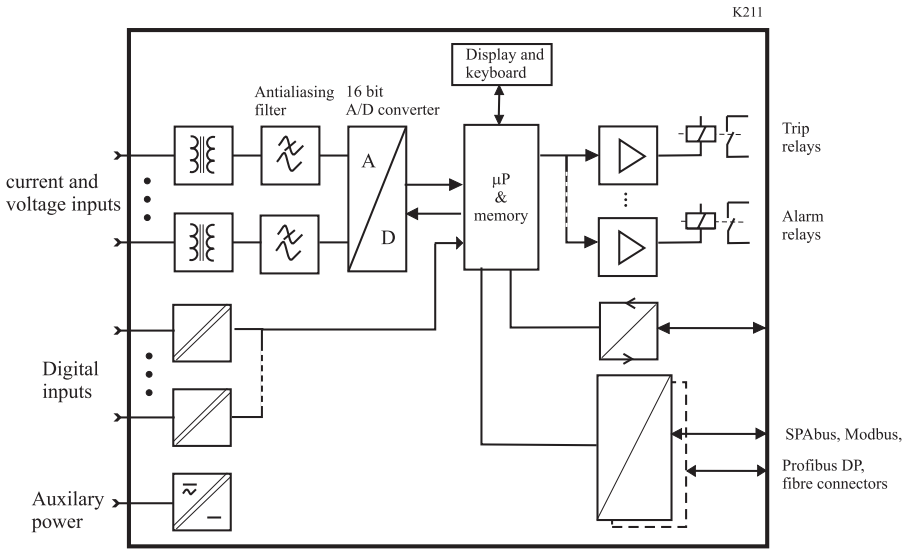


Figure 2.1-1. Principle block diagram of a numerical protection relay.

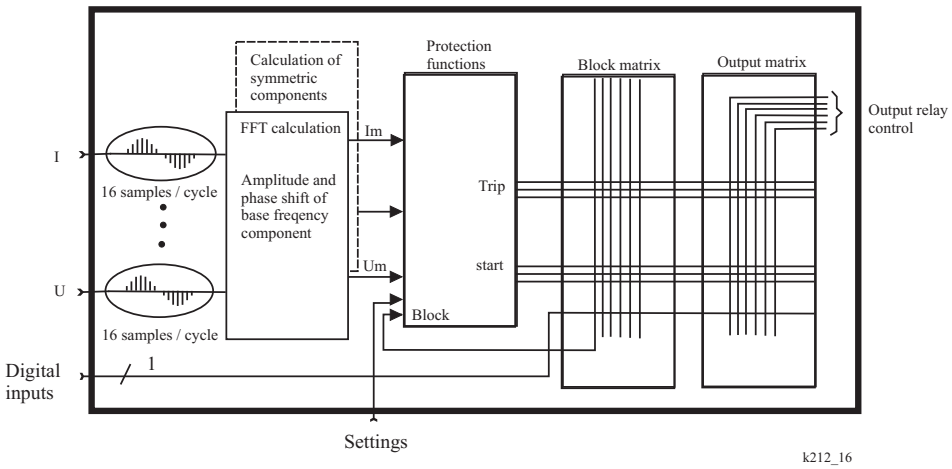


Figure 2.1-2. Block diagram of a signal processing and protection software.

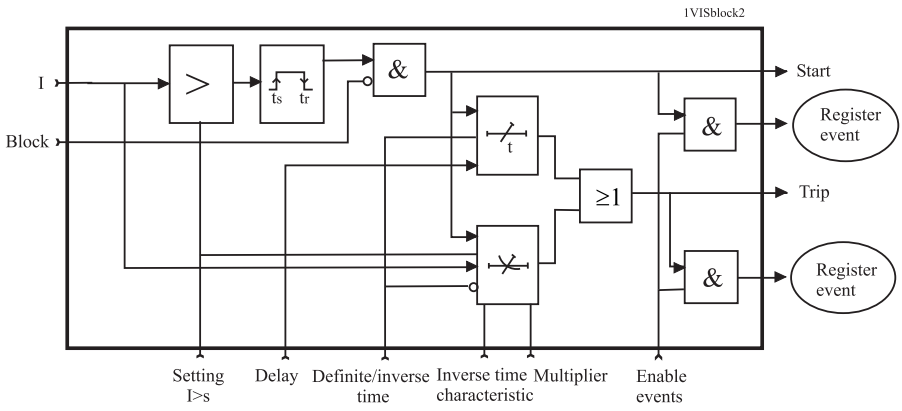


Figure 2.1-3. Block diagram of a basic protection function.

2.2. Relay protection functions

2.2.1. Overcurrent protection I>, I>>, I>>> (50/51)

The three-phase overcurrent unit comprises three separately adjustable overcurrent stages, i.e. stage I>, I>> and I>>>.

The overcurrent unit measures the fundamental frequency component of the phase currents.

Stage I> can be configured for definite time or inverse time operation characteristic. Stage I>> and stage I>>> have definite time characteristic.

Figure 2.2.1-1 shows the functional block diagram of stage I>.

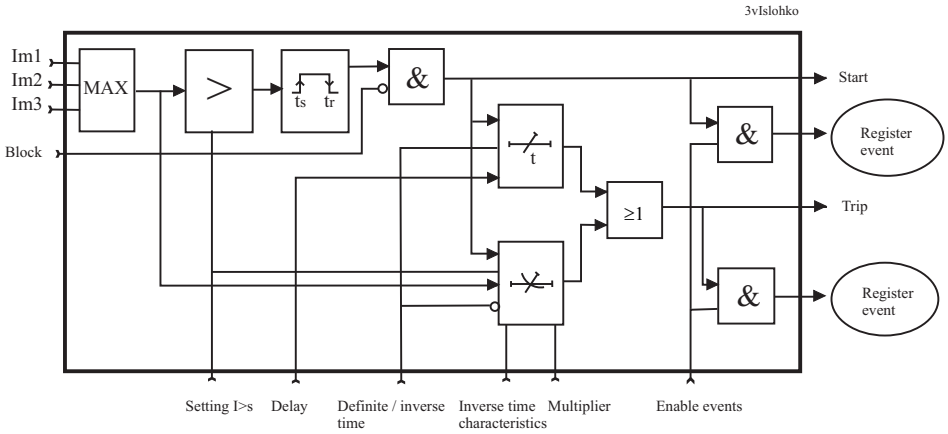


Figure 2.2.1-1. Block diagram of the three-phase overcurrent stage I>.

Parameters of the overcurrent stages:

I>, I>>, I>>> (50/51)

	Parameter	Value/unit	
Measured value	ILmax	A	Max. value of phase currents IL1, IL2, IL3 primary values
Setting values	I>, I>>, I>>>	A	Calculated setting value in primary current units
	I>, I>>, I>>>	xImot	Setting value as per unit value
	Type	DT	Operation charact./ definite time (I>)
		NI, VI EI, LTI	Operation charact./ inverse time (I>)
	t>, t>>, t>>>	s	Operation time
	k		Time multiplier at inverse time (I>)

Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Type	1-N, 2-N 3-N	Fault type/single-phase fault e.g.: 1-N = fault on phase L1
		1-2, 2-3 1-3	Fault type/two-phase fault e.g.: 2-3 = fault between L2 and L3
		1-2-3	Fault type/three-phase fault
	Flt	xImot	Max. value of fault current as compared to In
	Load	xImot	1 s mean value of pre-fault phase currents IL1…IL3
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

The low-set stage (I>) of the overcurrent unit can be configured for inverse time characteristic. Four sets of characteristic curves according to IEC 60255-3 are available for the low-set stage, i.e.: Normal Inverse (NI), Very Inverse (VI), Extremely Inverse (EI) ja Long Time Inverse (LTI). The mathematical expressions and the curve sets are given in Figure 2.2.1-3, Figure 2.2.1-4, Figure 2.2.1-5 and Figure 2.2.1-6.

Limitations:

1. The maximum measured current is 50 x I_n. This limits the scope of inverse curves when the setting is more than 2.5 x I_n. E.g. at setting 4 x I_n the maximum setting relative current is 12.5 x I_{set}/I_n although the curves are defined up to 20 x I_{set}/I_n
2. The fastest possible operating time is about 60 ms at inverse time characteristic according to curve types VI and EI.

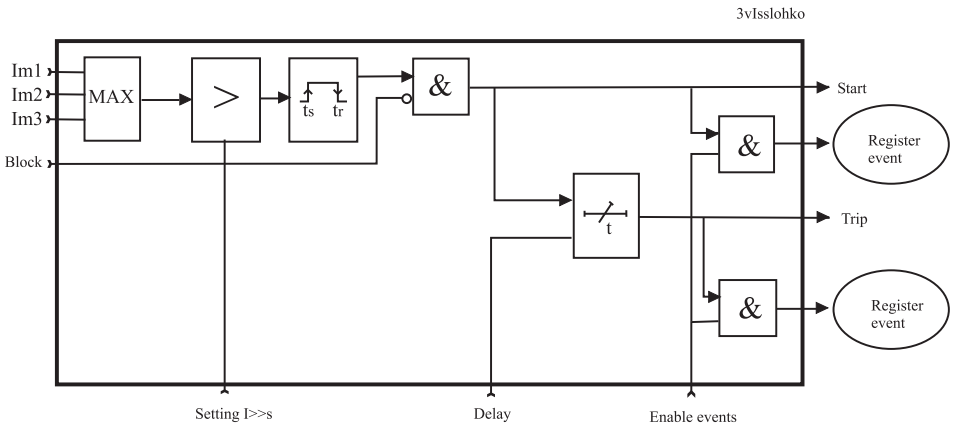


Figure 2.2.1-2. Block diagram of the three-phase overcurrent stages I>> and I>>>.

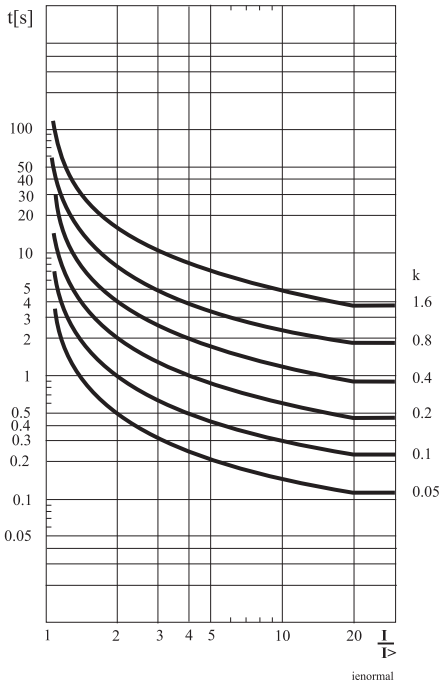


Figure 2.2.1-3. Normal Inverse (IEC 60255-3) characteristic.

$$t[s] = 0{,}14 \cdot \frac{k}{(\frac{I}{I>})^{0{,}02} - 1}$$

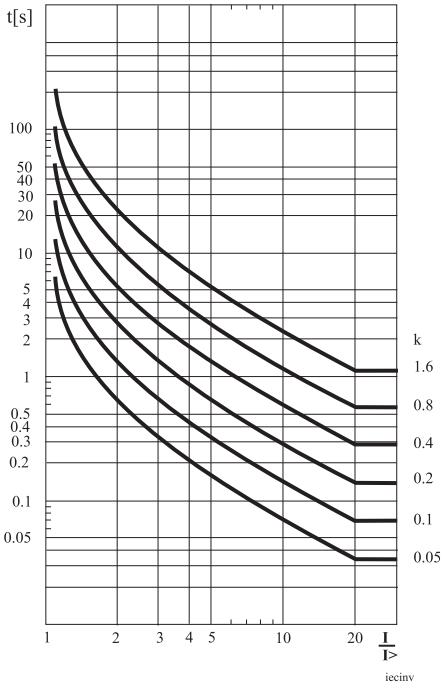


Figure 2.2.1-4. Very Inverse (IEC 60255-3) characteristic.

$$t[s] = 13{,}5 \cdot \frac{k}{(\frac{I}{I>}) - 1}$$

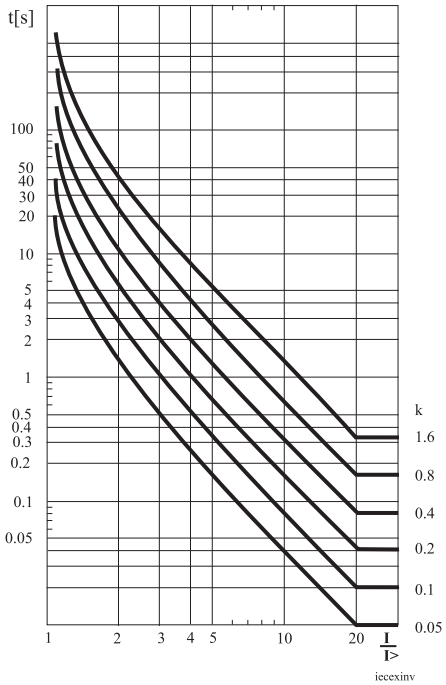


Figure 2.2.1-5. Extremely Inverse (IEC 60255-3) characteristic.

$$t[s] = 80 \cdot \frac{k}{(\frac{I}{I>})^2 - 1}$$

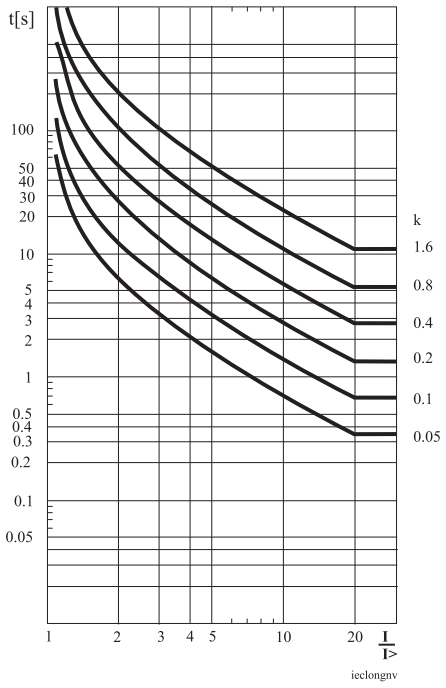


Figure 2.2.1-6. Long Time Inverse (IEC 60255-3) characteristic.

$$t[s] = 120 \cdot \frac{k}{(\frac{I}{I>}) - 1}$$

2.2.2. Stall protection I_{st}> (48)

The stall protection unit I_{st}> measures the fundamental frequency component of the phase currents.

Stage I_{st}> can be configured for definite time or inverse time operation characteristic.

The stall protection stage protects the motor against prolonged starts caused by e.g. a stalled rotor. While the current has been less than I_{Stop} = 10% x I_{mot} and then within 200 milliseconds exceeds $I_{StartMin}$ the stall protection stage starts to count the operation time T according to equation 2.2.2. The equation is also drawn in Figure 2.2.2-1. When current drops below 120 % x I_{MOT} the stall protection stage releases.

Equation 2.2.2.-1

$$T = \frac{I_{START}}{I_{MEAS}} T_{START}$$

where,

T = Operation time

I_{START} = Start current of the motor. Default 6.00xI_{MOT}

I_{MEAS} = Measured current during start

T_{START} = Maximum allowed start time for the motor

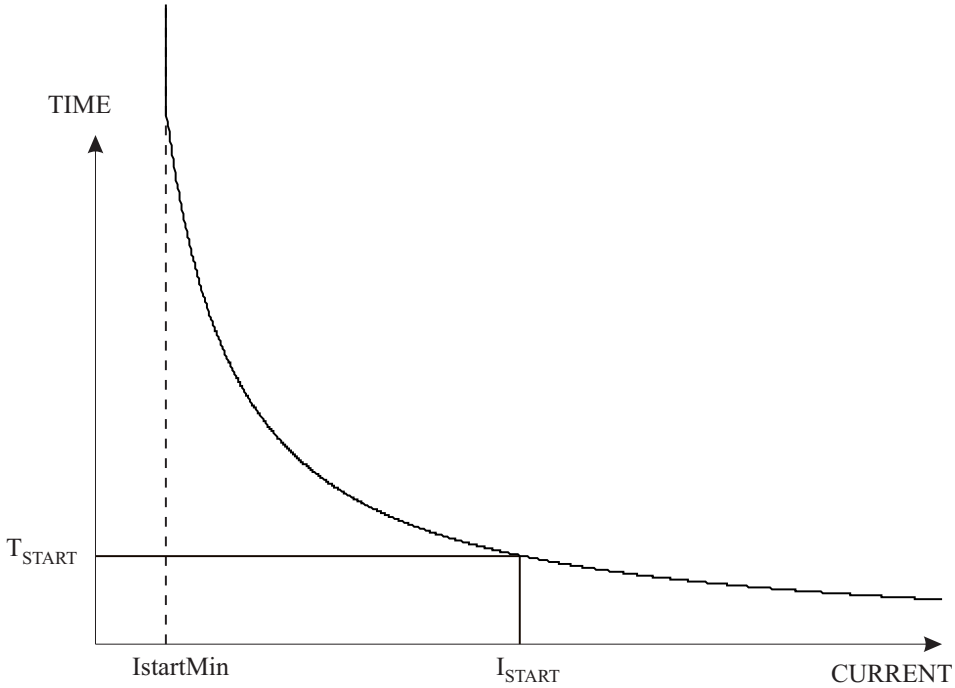


Figure 2.2.2-1. Operation time delay of the stall protection stage I_{st}>.

If the measured current is less than the specified start current I_{START} the operation time will be longer than the specified start time T_{START} and vice versa.

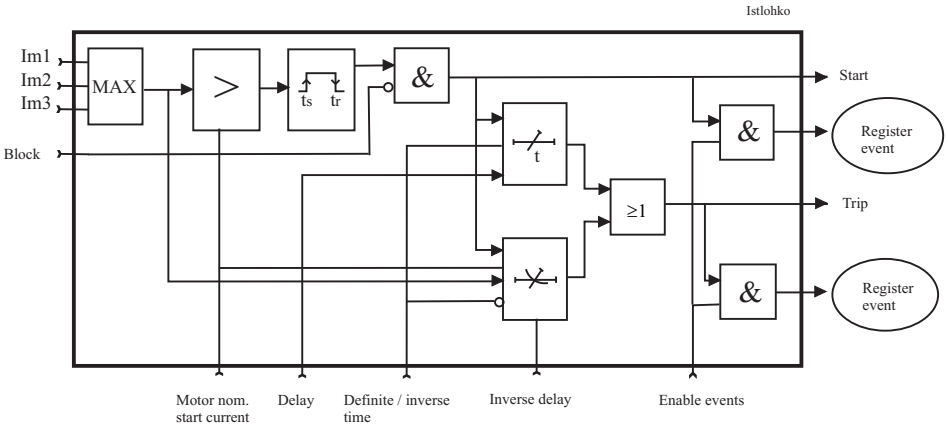


Figure 2.2.2-2. Block diagram of the stall protection stage I_{st}>.

Parameters of the stall protection stage:

I_{st}> (48)

	Parameter	**Value/unit**	
Setting values	ImotSt	xImot	Nominal motor starting current
	Ist>	%Imot	Start detect current. Must be less than initial motor starting current.
	Type	DT	Operation charact./ definite time
		Inv	Operation charact./ inverse time
	tDT>	s	Operation time [s]
	tInv>	s	Time multiplier at inverse time
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Flt	xImot	Max. value of fault.
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

2.2.3. Thermal overload stage T> (49M)

The overload stage measures the rms value of the phase currents including harmonics up to 7th and calculates the temperature dependent operation time according to the equation 2.2.3.-1 (IEC 60255-8).

Equation 2.2.3.-1

$$T = \tau \cdot \ln \frac{I^2 - I_P^2}{I^2 - I^2{}_{MAX}}$$

where,

T = Operation time. This is a result value.

τ = Thermal time constant of the motor. This is a base value. The actual time constant depends of the status of the stage (heating, cooling or stall). This is a setting value.

I = The highest rms value of the three measured phase currents. The rms value will include harmonics up to 7^{th}. This is a measured value.

I_P = Pre-load current corresponding to the present modelled temperature. This is an internal calculated value.

I_{MAX} = The maximum allowed continuous current corresponding the maximum allowed temperature Θ_{MAX}. The temperature Θ_{MAX} is the trip limit and also equals the heat capacitance of the protected motor. The value of I_{MAX} is derived from overcurrent factor k, given ambient temperature Θ_{AMB} and parameters $k_{\Theta 40}$ and $k_{\Theta 70}$. See Figure 2.2.3-1.

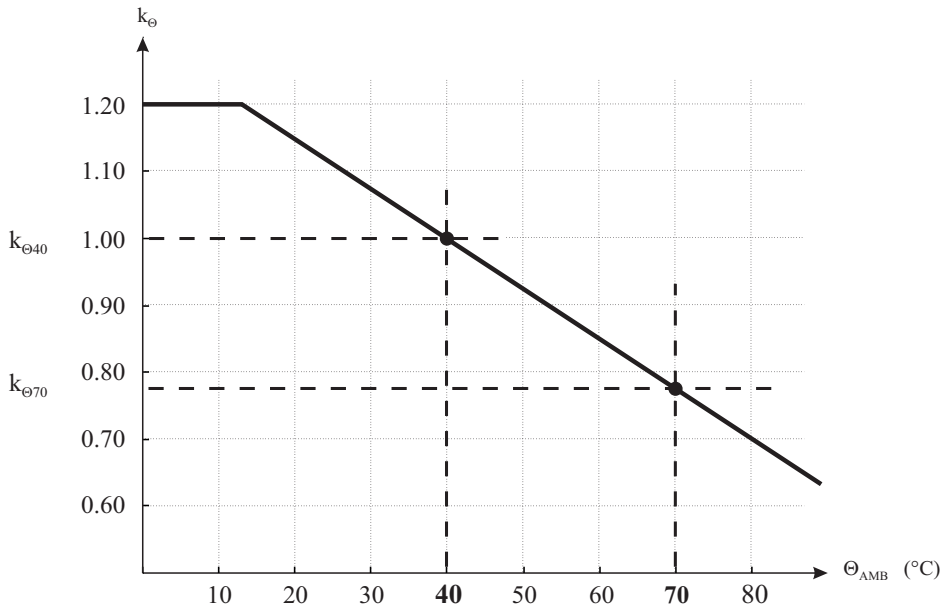


Figure 2.2.3-1. Ambient temperature correction of the overload stage T>.

Ambient temperature correction for the maximum allowed continuous current used by the thermal overload stage. The slope is defined by the user giving the relative motor currents at ambient temperatures +40 °C and +70 °C. The default values are I_{MAX40} = 100% and I_{MAX70} = 78%.

The device is updating the thermal image continuously. If the calculated temperature exceeds the given alarm limit Θ_{ALARM} the stage gives out a start signal. When the temperature exceeds the trip level Θ_{TRIP} the stage activates the trip signal. The start and trip signals are controlling the output relays via the user configured output relay matrix. The start signal is not released until the temperature is $\Theta_{DEADBAND}$ below Θ_{MAX}. The temperature dead band $\Theta_{DEADBAND}$ is 10 % x Θ_{TRIP}.

Whenever the current is below I_{STOP} the motor is supposed to be stopped and a longer time constant is used for modeling the temperature. The maximum current for a stopped motor I_{STOP} is 10 % x I_{MOT}.

Parameters of the thermal overload stage:

T> (49M)

	Parameter:	Value/unit:	
Measured value	T>	%	Temperature rise of stator
Setting values	T>	xI_{MOT}	Max. allowed continuous current as compared to I_{MOT}
	Alarm	%	Temperature alarm limit
	Tau	min	Time constant of the motor
	Tau2	xTau	Cooling time multiplier for Tau
	I_{MAX40}	xI_{MOT}	Relative allowed overload when Θ_{AMB} is +40 °C
	I_{MAX70}	xI_{MOT}	Relative allowed overload when Θ_{AMB} is +70 °C
	Tamb	°C	Ambient temperature
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Load	A	1s mean value of pre-fault phase currents as compared to I_{MOT}
	Flt	A	Max. value of fault current as compared to I_{MOT}
	FltT	%	Max. value of fault temperature
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

If the motor manufacturer gives a t_{6x} value instead of τ, the τ can be calculated using equation 2.2.3.-2 assuming that the t_{6x} is given for a motor in normal operating temperature. If the t_{6x} is given for a cold motor then equation 2.2.3.-3 should be used.

Equation 2.2.3.-2

$$\tau = 71 \cdot t_{6x}$$

Equation 2.2.3.-3

$$\tau = 35.5 \cdot t_{6x}$$

The trip level is determined by the maximum allowed continuous current I_{MAX}. This current corresponds to the 100 % temperature Θ_{TRIP} i.e. the heat capacitance of the motor. I_{MAX} depends of the setting k and setting Θ_{AMB}, I_{MAX40} and I_{MAX70}.

$$I_{MAX} = k \cdot k_{\Theta} \cdot I_{MOT}$$

The value of ambient temperature factor k_{Θ} depends on the setting Θ_{AMB}, I_{MAX40} and I_{MAX70}. See Figure 2.2.3-1.

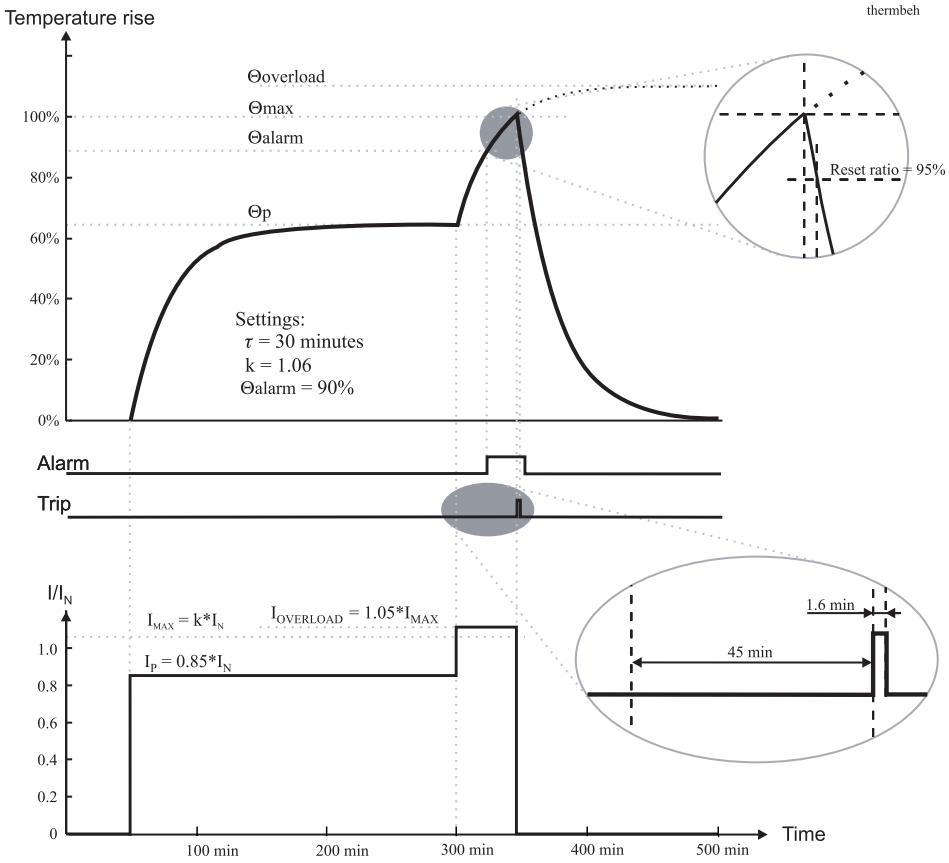


Figure 2.2.3-2. Behaviour of VAMP 150 T> protection stage

2.2.4. Unbalance protection I2> (46)

The unbalance stage protects the motor against unbalanced phase currents and single phasing. The protection is based on the negative sequence current.

Both definite time and inverse time characteristics are available. The inverse delay is based on equation 2.2.4.-1. Only the base frequency components of the phase currents are used to calculate the negative sequence value I_2.

Equation 2.2.4.-1

$$T = \frac{K_1}{(\frac{I_2}{I_{MOT}})^2 - K_2^2}$$

where,

T = Operation time

K_1 = Thermal time constant of the rotor (I_2^2t value)

I_2 = Negative sequence phase current, base frequency component

I_{MOT} = Nominal current of the motor

K_2 = The maximum allowed degree of unbalance

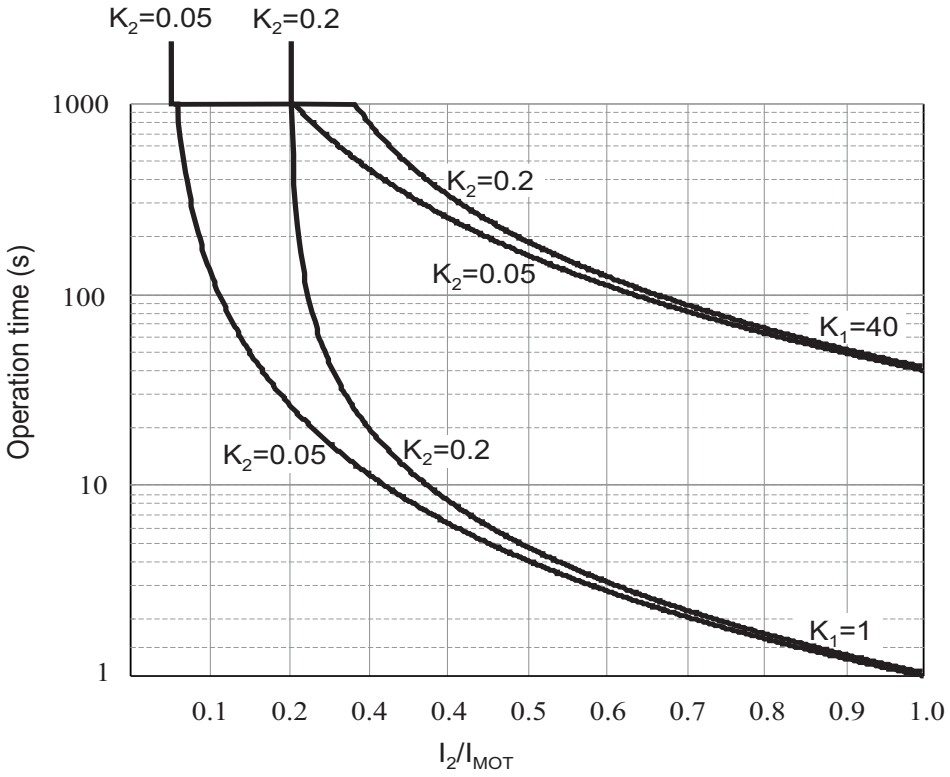


Figure 2.2.4-1. Inverse operation delay of current unbalance stage I_2>. The longest delay is limited to 1000 seconds (=16min 40s).

Parameters of the current unbalance stage:

I_2> (46)

	Parameter:	Value/unit:	
Measured value	I2/I_{MOT}	%	Negative phase sequence current as per times I_{MOT}
Setting values	I2>	%	Start current as per times I_{MOT}
	Type	DT	Operation charact./ definite time
		INV	Operation charact./ inverse time
	t>	s	Operation time [s] at definite time function
	K1>		Time multiplier at inverse time
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Flt	%	Max. value of fault current as per times I_{MOT}
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

2.2.5. Incorrect phase sequence protection I2>>

The phase sequence stage prevents the motor from running in the wrong direction, thus protecting the load.

When the ratio between negative and positive sequence current exceeds 80%, the phase sequence stage starts and trips after 100 ms.

Parameters of the incorrect phase sequence stage:

I2>> (46)

	Parameter:	Value/unit:	
Measured value	I2/I1	%	Neg. phase seq. current/pos. phase seq. current
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Flt	%	Max. value of fault current
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

2.2.6. Undercurrent protection I< (37)

The three-phase undercurrent unit measures the fundamental frequency component of the phase currents.

The stage I< can be configured for definite time characteristic.

The undercurrent stage is protecting rather the device driven by the motor e.g. a submersible pump, than the motor itself.

Parameters of the undercurrent stage:

I< (37)

	Parameter:	Value/unit:	
Measured value	IL_{MIN}	A	Min. value of phase currents IL1..IL3 in primary value
Setting values	I<	xI_{MOT}	Setting value as per times I_{MOT}
	t<	s	Operation time [s]
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Type	1-N, 2-N 3-N	Fault type/single-phase fault e.g.: 1-N = fault on phase L1
		1-2, 2-3 1-3	Fault type/two-phase fault e.g.: 2-3 = fault between L2 and L3
		1-2-3	Fault type/three-phase fault
	Flt	%	Min. value of fault current as per times I_{MOT}
	Load	%	1s mean value of pre-fault currents IL1—IL3
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

2.2.7. Sensitive earth-fault protection I_0>(50/51N)

The earth-fault unit of the motor protection relay VAMP 150 is provided with two energizing inputs rated 5 A and 1 A.

The earth-fault unit measures the fundamental frequency component Io. In the VAMP 150 relay this means that the degree of attenuation of the third harmonic is at least 60 dB, which contributes to the extremely high accuracy of the earth-fault protection.

Stage I_0> can be configured for definite time characteristic. Stage I_0>> can be configured for definite time or inverse time operation characteristic.

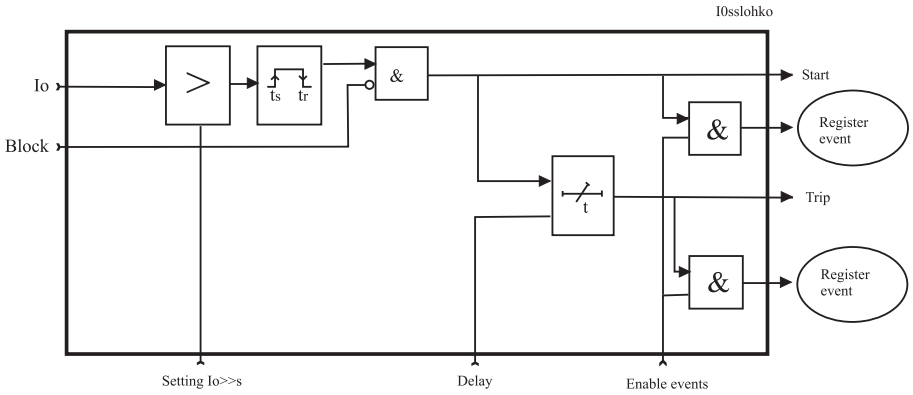


Figure 2.2.7-1. Block diagram of the earth-fault stage I_0>.

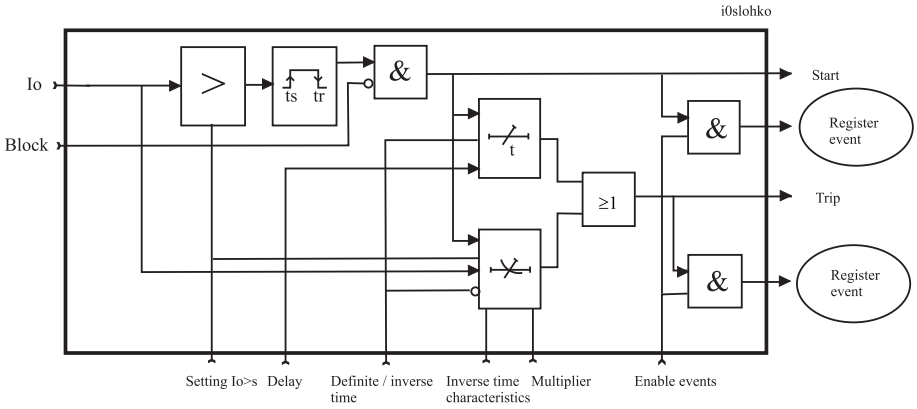


Figure 2.2.7-2. Block diagram of the earth-fault stage I_0>>.

Parameters of the earth-fault stage:

I_0> (50/51N)

	Parameter:	Value/unit:	
Measured value	I_0	A	Earth-fault current in primary value
Setting values	I_0>	A	Setting value in primary value
	I_0>	pu	Setting value as per unit value
	t>	s	Operation time [s]
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Flt	pu	Max. value of fault current in primary value
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

Parameters of the earth-fault stage:

I_0>> (50/51N)

	Parameter:	Value/unit:	
Measured value	I_0	A	Earth-fault current in primary value
Setting values	I_0>>	A	Setting value in primary value
	I_0>>	pu	Setting value as per unit value
	Type	DT	Operation charact./ definite time
		INV	Operation charact./ inverse time
	t>>	s	Operation time [s]
	k>>		Time multiplier at inverse time
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Flt	pu	Max. fault current in primary value
	EDly	%	Elapsed time as compared to the set operate time, 100% = tripping

2.2.8. Frequent start protection N> (66)

The simplest way to start an asynchronous motor is just to switch the stator windings to the supply voltages. However every such start will heat up the motor considerably because the initial currents are significantly above the rated current.

If the motor manufacturer has defined the maximum number of starts within on hour or/and the minimum time between two consecutive starts this stage is easy to apply to prevent too frequent starts.

When current has been less that I_{STOP} and then exceeds $I_{StartMin}$ the situation is recognized as a start. The maximum current for a stopped motor I_{STOP} is 10 % x I_{MOT}. The minimum current for a just started motor $I_{StartMin}$ is 150 % x I_{MOT}.

The stage will give a start signal when the second last start has been done. The trip signal is normally activated and released when there are no starts left. Figure 2.2.8-1 shows an application.

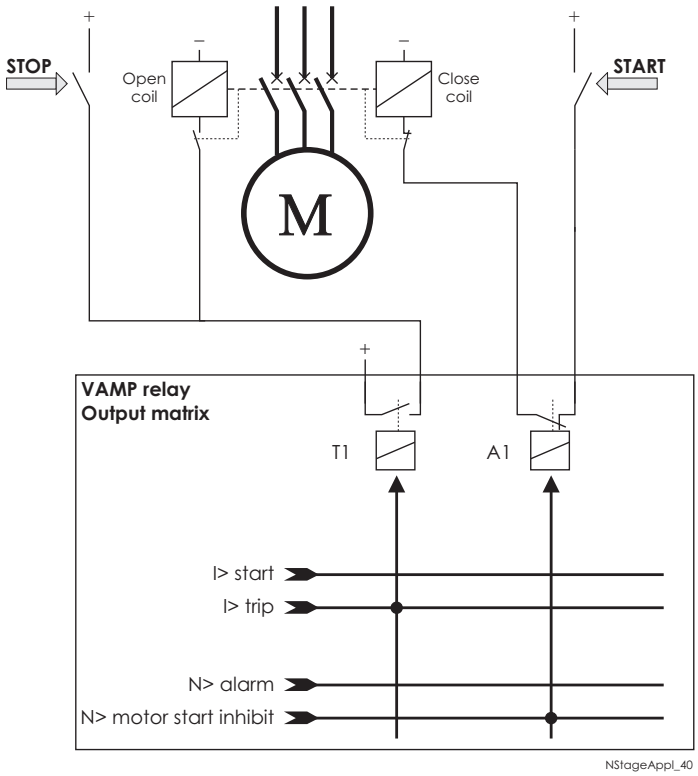


Figure 2.2.8-1. Application for preventing too frequent starting, using the N> stage. The relay A1 has been configured to be "normal closed". The start is just an alarm telling that there is only one start left at the moment.

Parameters of the frequent start protection:

N> (66)

	Parameter	Value/unit	
Measured value	Mot strs		Motor starts in last hour
	T	min	Elapsed time from motor start
Setting values	Sts/h		Max. starts in one hour
	Interval	min	Min. interval between two consecutive starts
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading
	Descr	1StartLeft	1 start left, activates the N> start signal
		MaxStarts	Max. start trip, activates the N> trip signal
		Interval	Min. interval between two consecutive starts has not yet been elapsed, activates the N> trip signal
	Tot Mot Strs		Number of total motor starts
	Mot Strs/h		Number of motor starts in last hour
	El. Time from mot Strt	min	Elapsed time from the last motor start

2.2.9. Arc fault protection (option) ArcI> (51L>), ArcI$_0$> (51NL>)

The arc fault protection has been realized with an arc sensor (or sensors) and an extremely fast overcurrent function Iarc and Ioarc using the arc optional card.

The arc protection unit operates, when the arc sensor detects an arc fault or the binary input (BI) of the arc option card is activated and the fast overcurrent stage ArcI> measures overcurrent simultaneously.

The earth-fault arc protection unit operates, when the arc sensor detects an arc fault or the binary input (BI) of the arc option card is activated and the earth-fault function ArcIo> measures earth-fault simultaneously.

The sensor connections (S1, S2) and binary input (BI) can be set, individually or any combination of these, to operate the ArcI> and ArcIo> protection stages.

The operating time of the arc protection stages are approximately 15 ms.

The sensor connections and binary input can be set to activate the binary output (BO) in the output matrix, DO menu. The binary output can be used to forward light information to another relay, e.g. VAMP 150. The binary output can be connected to a maximum of three binary inputs of another relay.

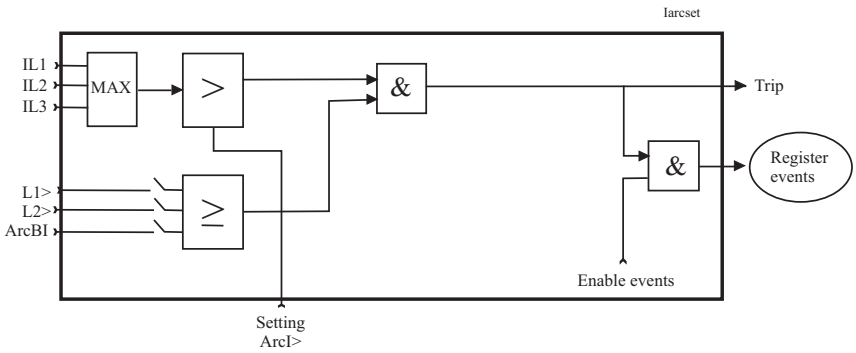


Figure 2.2.9-1. Block diagram of the arc protection stage ArcI>. The symbol of the starting of the arc sensor is L> and that of the fast overcurrent stage is ArcI.

The setting of the arc protection stage is performed in the menu called IL SETTING/ArcI Set.

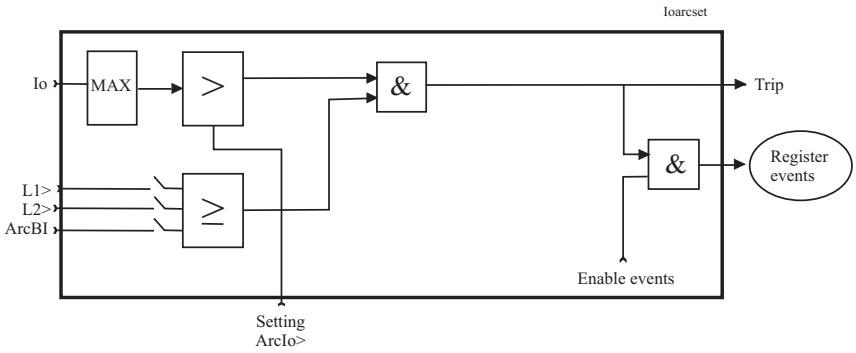


Figure 2.2.9-2. Block diagram of the arc protection stage ArcIo>. The symbol of the starting of the arc sensor is L> and that of the fast earth-fault stage is ArcIo.

The setting of the earth-fault arc protection stage is performed in the menu called Io SETTING/ArcIo Set.

Parameters of the arc protection stage ArcI> (51L>):

	Parameter:	Value/unit:	
Measured value	IL max	A	Max. value of phase currents IL1, IL2, IL3 primary values
Setting values	ArcI>	pu	Setting value as per times In
	ArcI> sensor		Selection of the arc sensor channel(s) and/or arc binary input
Recorded values	SCntr		Cumulative start counter, only selected ArcCn arc activations
	TCntr		Cumulative trip counter, only selected ArcCn arc activations
	Flt	%	Maximum value of fault current as per times In
	EDly	%	Elapsed time as compared to the set operating time, 100%=tripping

Parameters of the arc protection stages ArcIo> (51NL>):

	Parameter:	Value/unit:	
Measured value	Io	A	Max. value of earth-fault current Io primary value
Setting values	ArcI>	pu	Setting value as per times Ion
	ArcI> sensor		Selection of the arc sensor channel(s) and/or arc binary input
Recorded values	SCntr		Cumulative start counter, only selected ArcCn arc activations
	TCntr		Cumulative trip counter, only selected ArcCn arc activations
	Flt	%	Maximum value of fault current as per times Ion
	EDly	%	Elapsed time as compared to the set operating time, 100%=tripping

2.2.10. Circuit-breaker failure protection CBFP (50BF)

The operation of the circuit-breaker failure protection is based on the supervision of the operating time, from the pick-up of the trip relay (T1) to the dropout of the same relay. If that time is longer than the set operating time of the CBFP stage, the CBFP stage is activated (trip relay T2) remaining activated, until the T1 relay resets. The supervised - and tripping relay can be configured.

The CBFP stage functions also in earth-fault situations, because its function is merely based on supervision of the function of the output relay T1.

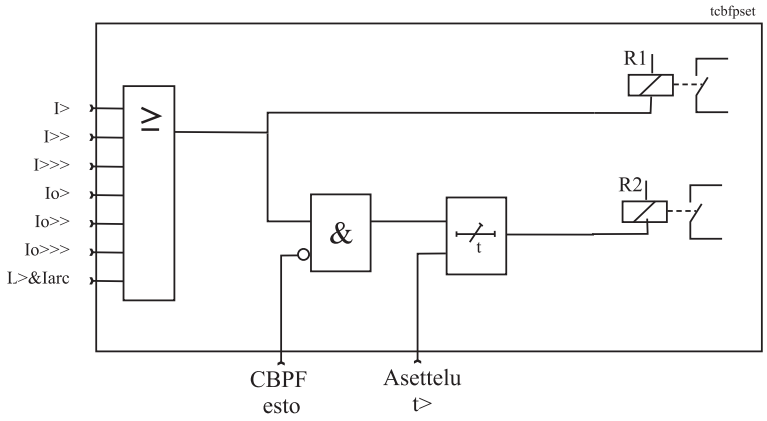


Figure 2.2.10-1. Block diagram of the circuit-breaker failure protection

The CBFP blocking signal prevents the CBFP stage from operating, when the output relays or any other protection function is operated by forced control.

Parameters of the circuit-breaker failure protection:

CBFP (50BF)

	Parameter:	Value/unit:	
Setting values	CBRel		Relay to be supervised
	t>	s	Operation time [s]
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading

2.3. Measurement functions of the relay

Measured values

Phase currents I_{L1}, I_{L2}, I_{L3}

Measuring range	0 – 50 x In	In = 1A or 5A

Residual current I_0

Measuring range	0 – 5 I_{0n}	I_{0n} = 1A or 5A

Frequency f

Measuring range	16 - 65 Hz

Calculated values

From the measured values the relay calculates the following:

- IL
- I2/I1, I2/I_{MOT}
- I_fault

2.4. Output relay and blocking functions

In the VAMP 150 relay all start and trip signals of the protection stages can be freely routed to the output relays and operation indicators according to the requirements of the application. The functions can also be blocked and for this purpose both internal relay signals and external control signals can be used. Figure 2.4-1 shows the operating principle of the grouping and blocking matrix.

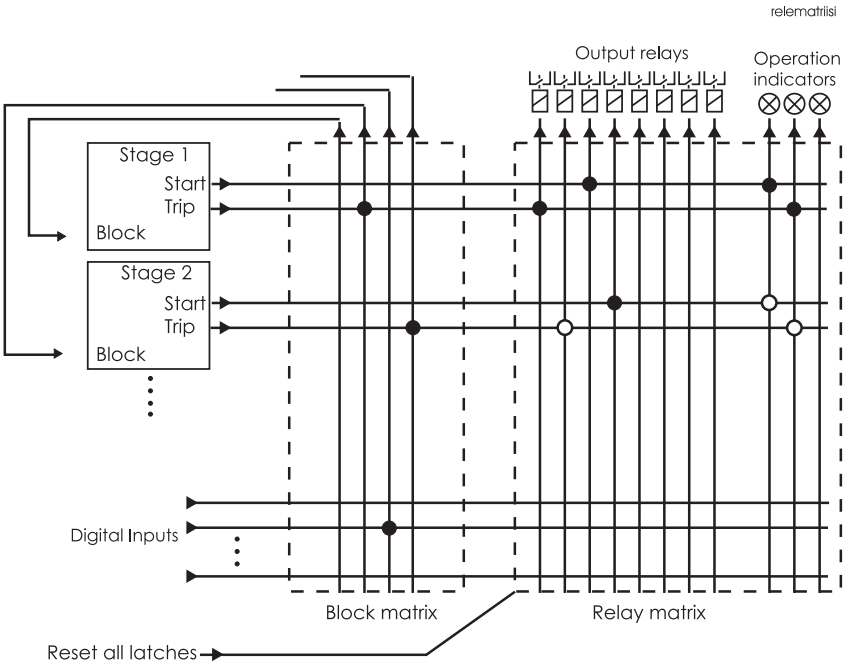


Figure 2.4-1. Operating principle of the grouping and blocking matrices.

2.4.1. Output relay matrix

By means of the relay matrix the output signals of the various protection stages can be combined with the trip relay T1 and T2, alarm relays A1...A3 and the operation indicator L1 (Alarm) and L2 (Trip).

When a connection is made, two functions can be selected, the signal follower function (o) or the latching function (•), see Figure 2.4-1.

The "Reset all latches" function resets all latched output relays and operation indicators. The reset signal can be given via a digital input, the key pad or the serial port. If the reset signal is to be given via the digital input DI1, the Remote Release ("RemRel") input DI1 must be configured to function as a reset input from DIGITAL IN/RemRel menu.

2.4.2. Blocking matrix

By means of the blocking matrix (Block matrix) the operation of a protection stage can be blocked. The blocking signal can originate from the digital input DI1, or it can be a start or trip signal from a protection stage. In Figure 2.4-1, an active blocking is indicated with a black dot (•) in the crossing point of a blocking signal and a signal to be blocked.

2.5. Communication

2.5.1. PC port

The PC port is used for on-site parameterization of the relay, for downloading of the program and for reading relay parameters to a PC.

For connection to a PC, one RS 232 serial port is available on the front panel of the relay. Any connection to the port is done with the connection cable type VX 003-3.

2.5.2. Remote control connection

The relay can be connected to higher level systems, e.g. network control systems via the serial port named REMOTE on the rear panel. To the port a SPA Bus, ModBus®, ProfiBus® or IEC-103 connection can be made using a special internal or external bus connection module. The bus type selection and the parameterization of the bus are carried out as the relay is configured.

Optional accessories are available for RS485 connection (VMA 3CG), Ethernet connection over TCP/IP protocol (VEA 3CG) and Profibus connection (VPA 3CG). Please see the corresponding documentation for more details.

Protocol	Standard interface	Internal option cards	External option modules		
	RS232: VX004-M3 or VX008-4	Plastic	RS485: VMA3CG + VX007-F3	ProfiBus: VPA3CG + VX007-F3	Ethernet: VEA3CG + VX015-3
ModBus	X	X	X		
SPA-Bus	X	X	X		
ProfiBus				X	
IEC-60870-5-103	X	X	X		
ModBus/ TCP					X
Transparent TCP/IP					X

Table 2.5.2-1 Communication protocols and physical interfaces on REMOTE serial port.

2.6. Disturbance recorder

The disturbance recorder can be used to record all measured signals i.e. currents and voltages, status information of digital inputs (DI) and digital outputs (DO). The digital inputs include also the Arc light information (S1, S2 and Arc binary input BI). The digital outputs include the Arc binary output information (BO).

Recorder capacity is 48 000 bytes. There can be a maximum of 5 recordings and the maximum selection of channels in one recording is 12 (limited in waveform recording).

The recorder can be triggered by any protection stage start or trip signal, Arc sensors (S1, S2, BI) and digital input. The trig signal is selected in the output matrix. The recording can also be triggered manually.

When recording is made also the time stamp will be memorized.

The recordings can be viewed by VAMPSET program, version 8.x or newer. The recording is in COMTRADE format so also other programs can be used to view the recordings.

For more detailed information, see separate Disturbance Recorder manual VMDR.EN0xx.

Available links

The following channels can be linked to Disturbance Recorder:

- IL1, IL2, IL3, IL
- IL1rms, IL2rms, IL3rms, ILrms
- Io
- f
- I2/I1, I2/In
- DI, DO

Parameters of the Disturbance Recorder

	Parameter:	Value/unit:	
Setting values	Mode		Mode of the recording
	Rate		Sample rate
	Time	s	Recording time
	PreTrig	%	Pre-trigger time
	MnlTrig		Manual trig
	Size		Size of one recording
	MAX time	s	Maximum time of recordings
	MAX size		Maximum size of recordings
Recorder links	Links		Connected links
	AddLink		Add links
	ClrLnks		Clear links

	Parameter:	Value/unit:	
Recorded values	Status		Status of the recorder
	Time status	%	Status of the pre-triggering
	ReadyRec		Number of ready records

2.7. Self-supervision

The functions of the micro controller and the associated circuitry as well as the program execution are supervised by means of a separate watchdog circuit. Besides supervising the relay the watchdog circuit attempts to restart the micro controller in a fault situation. If the restarting fails the watchdog issues a self-supervision alarm because of a permanent relay fault.

When the watchdog circuit detects a permanent fault it always blocks any control of the other output relays, except for the self-supervision output relay.

Also the internal supply voltage is supervised. Should the auxiliary supply of the relay disappear, an IF alarm is automatically given. The IF relay contact is normally closed type of contact. This means that the IF relay contact is closed, when there is an internal fault or there is no auxiliary power supply. If the relay is fully operational with the auxiliary power supply, the IF contact is on the open position.

3. Application examples

3.1. Using the alarm of T> stage for restart inhibition

It is useful to inhibit the starting of a motor in case the start would lead to an immediate trip by the thermal protection stage. By setting the Θ_{ALARM} properly the signal given by the temperature alarm can be used to inhibit this kind of starts. See Figure 3.1-1 and curves 4 and 5 in Figure 3.1-2.

Figure 3.1-2 shows an example of how the temperature is calculated from the measured current. The events in this figure are:

- 10 minutes

The motor is started for the first time after a long off time. The simulated temperature starts to rise from 0% proportionally to the square of the current and to the given time constant τ.

After some tens of seconds the current stabilizes to value I_{load} and temperature starts to approach Θ_{load} (curve 1). The given time constant τ is used because the current exceeds I_{STOP}.

- 15 minutes

The motor is switched off and temperature starts to approach 0% now using the prolonged time constant k_τ x τ (curve 2).

- 20 minutes

The motor is started again. The temperature starts to rise using the time constant τ. After some tens of seconds the current stabilizes to value I_{load} and temperature starts to approach Θ_{load} (curve 3).

- 25 minutes

The motor is switched off and temperature starts to approach 0% now using the prolonged time constant k_τ x τ (curve 4).

- 30 minutes

Starting of the motor is inhibited, because the temperature is at the moment above the setting Θ_{ALARM}. Starting now would raise the temperature well above the trip level Θ_{TRIP} = 100% (curve 5).

- 38 minutes

Starting of the motor is possible again because the temperature is now below the setting Θ_{ALARM}. A start at this moment would rise the temperature near the trip level Θ_{TRIP} = 100% but not over it.

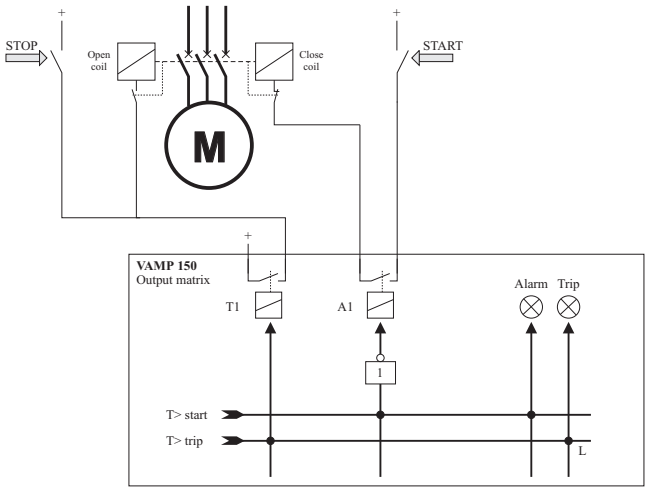


Figure 3.1-1. Application where the T> start signal prevents starting of the motor if the starting would cause heating over the trip limit Θ_{TRIP}. The T> start signal is active when the calculated temperature exceeds the setting value Θ_{ALARM}. The relay A1 is configured to be "normal closed".

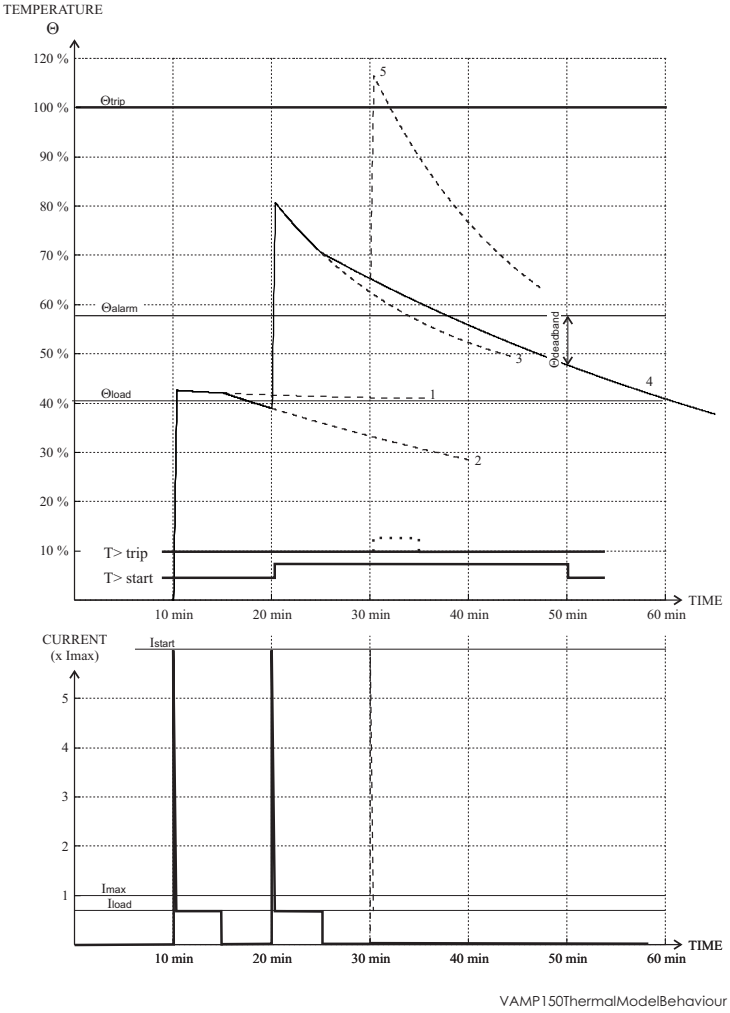


Figure 3.1-2. Example of modelled motor temperatures by the thermal overload stage when current has been cut off enough long so that the motor has cooled down. The temperature curve 5 describes an inhibited start attempt.

3.2. Trip circuit supervision

Trip circuit supervision is used to ensure that the wiring from protective relay to the circuit breaker is in order. This circuit is most of the time unused but when the protection relay detects a fault in the network it is too late to notice that the circuit breaker cannot be tripped because of a broken trip circuitry.

A digital input of the relay can be used for trip circuit monitoring.

- The digital input is connected parallel with the trip contacts (Figure 3.2-1).
- A resistor module VR10CB enables supervision also when the circuit breaker is open. The module consist resistor for 110 Vdc and 220 Vdc and is connected according the auxiliary voltage.
- The digital input is configured as Normal Closed (NC).
- The digital input delay is configured longer than maximum fault time to inhibit any superfluous trip circuit fault alarm when the trip contact is closed.
- The trip relay should be configured as non-latched. Otherwise a superfluous trip circuit fault alarm will follow after the trip contact operates and remains closed because of latching.

Figure 3.2-1 shows the situation when the circuit breaker is closed. If the digital input is not in active state it indicates that there is something wrong in the trip circuitry.

Figure 3.2-2 shows the situation when the circuit breaker is open. The resistor module VR10CB ensures that the digital input is in active state also in this situation. If the digital input is not in active state it indicates that there is something wrong in the trip circuitry.

If a communication protocol is in use the digital input event will tell the control system that there is a circuit breaker failure.

If serial communication is not in use, any of the unused output relays can be configured to follow the state of the inverted and delayed digital input. This relay will then give a "trip circuit failure" alarm to the control system if there is a failure.

The user may also configure a dedicated digital input event text, e.g. "TRIP CIRCUIT FAILURE", to be displayed on the local display of the protective relay whenever there is a trip circuit failure.

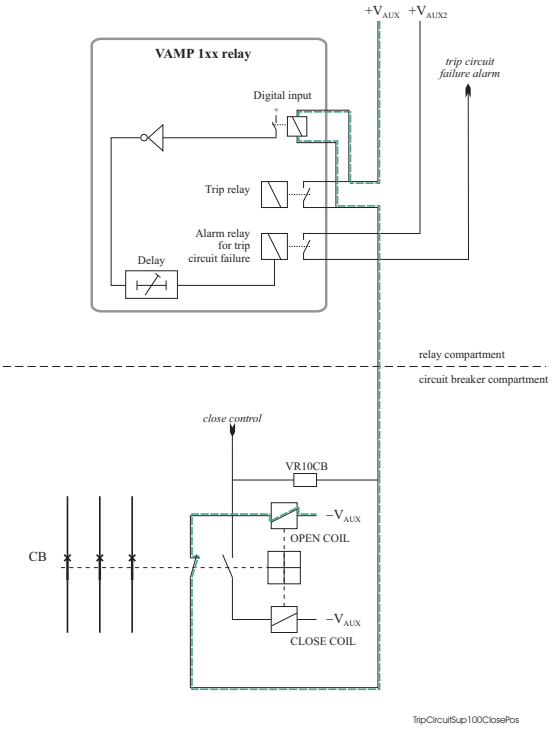


Figure 3.2-1. Trip circuit supervision when the circuit breaker is closed. The supervised circuitry in this CB position is marked with an extra parallel line. The digital input is in active state.

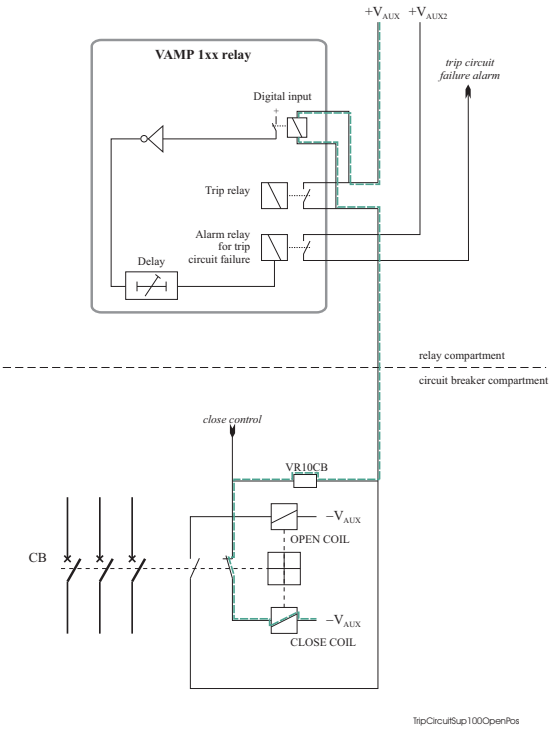


Figure 3.2-2. Trip circuit supervision when the circuit breaker is open. The supervised circuitry in this CB position is marked with an extra parallel line. The resistor device VR10CB offers an active input state for the digital input although the open coil auxiliary contact is open.

4. Connections

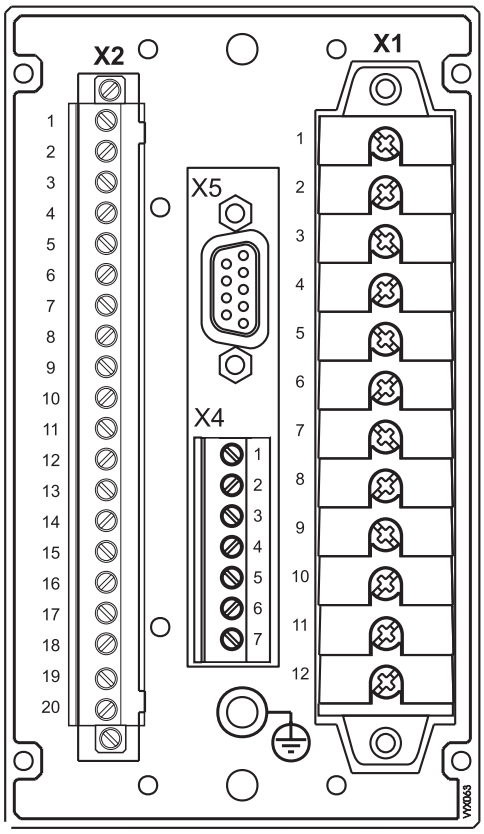


Figure 4-1. Connections on the rear panel of the VAMP 150 relay.

The VAMP 150 relay is connected to the protected object through the following measuring and control connections:

- Phase currents IL1, IL2 and IL3 (terminals X1: 1-6)
- Residual current I0 (5 A input: terminals X1: 9-10, 1 A input: terminals X1: 7-8)

4.1. Digital input

Further the relay can collect position information and alarm signals via the digital input (terminals X2: 4-5) and store the information in the event register.

The digital inputs can be used to:

- Block protection stages under certain conditions.
- Get time stamped event code from any auxiliary contact.
- Control the output relays.
- Supervise the trip circuit.

Potential-free contacts for position indication must be available in the protected application.

4.2. Auxiliary voltage

The external auxiliary voltage Uaux (standard 40 to 265 V ac/dc or 24 V dc, option B) for the relay is connected to the terminals X1: 11 - 12

Note:

Polarity of the auxiliary voltage U_{aux} (24 V dc, option B):
+ = X1:11 and - = X1:12.

4.3. Output relays

The VAMP 150 relay is equipped with five configurable output relays and a separate output relay for the self-supervision system

- Trip relays T1 and T2 (terminals X2: 19 - 20 and 16 - 17)
- Alarm relays A1 - A3 (terminals X2: 13 - 14, 11 - 12 and 9 - 10)
- Self-supervision system output relay IF (terminals X2: 7 - 8)
- The trip relay T2 can also be used for alarm purposes.

4.4. Serial communication connections

- RS 232 serial communication connection for computers, connector LOCAL (RS 232), connector on the front panel of the relay
- Remote control connection, connector REMOTE (TTL) on the rear panel of the relay (terminal X5). See also Table 2.5.2-1.

4.5. Current transducer

The output signal, i.e. 0 - 20 mA or 4 - 20 mA, of the integrated mA transducer is available on terminal X2: 1 - 2.

Available couplings to the analog output

- I_{L1}, I_{L2}, I_{L3}, I_L
- I_0
- f
- I2/I1
- I_{Fault}

4.6. Arc protection

The optional arc protection card includes two arc sensor channels. The arc sensors are connected to terminals X4: 4-5 and 6-7.

The arc information can be transmitted and/or received through the binary input and output channels. This is a 48 Vdc signal.

Connections:

X4: 1 Binary input (BI)

X4: 2 Binary output (BO)

X4: 3 GND (connect between relays)

X4: 4 Arc sensor 1 +

X4: 5 Arc sensor 1 -

X4: 6 Arc sensor 2 +

X4: 7 Arc sensor 2 -

4.7. Block diagram

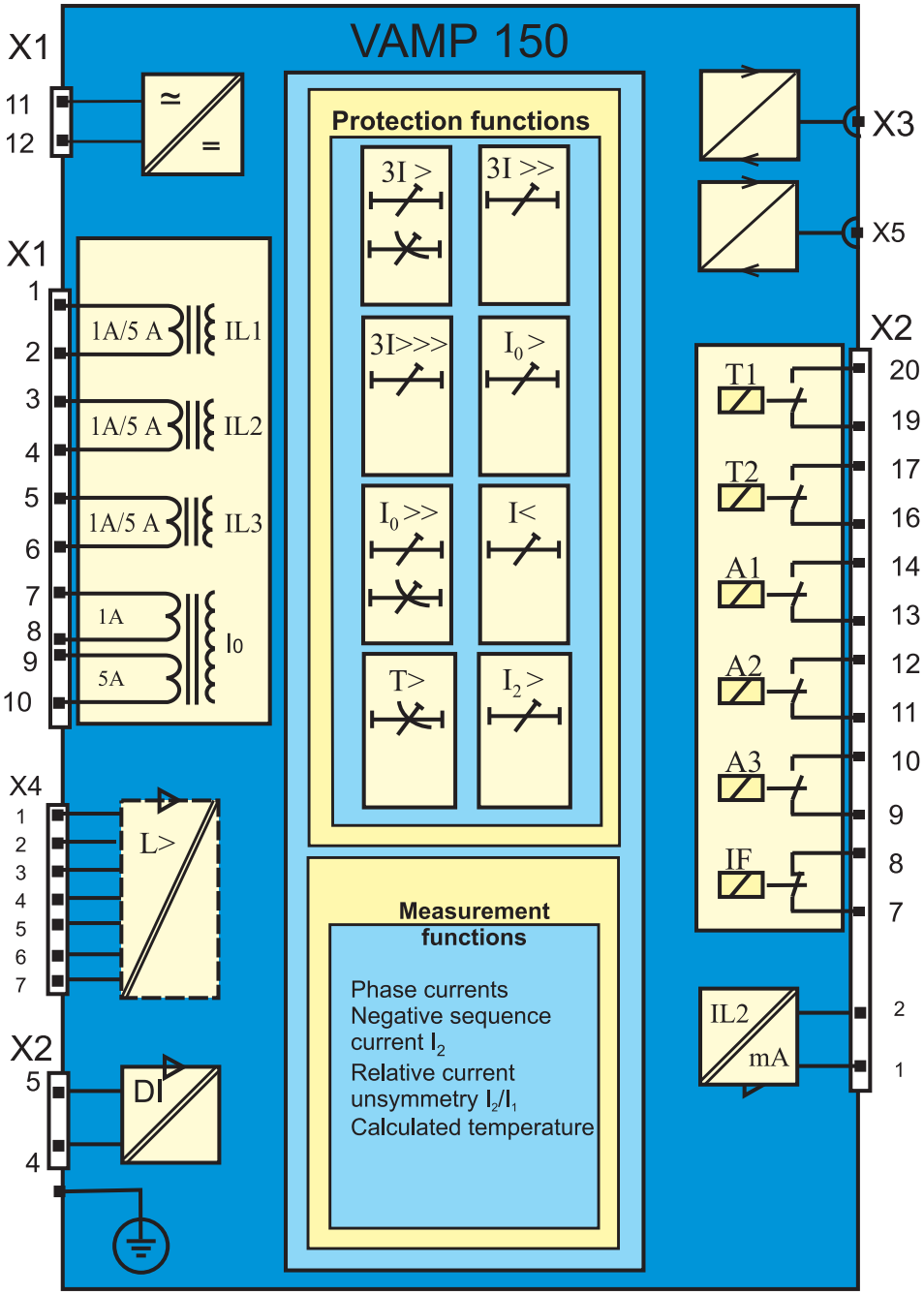


Figure 4.7-1. Block diagram of the motor protection relay VAMP 150.

4.8. Connection diagram

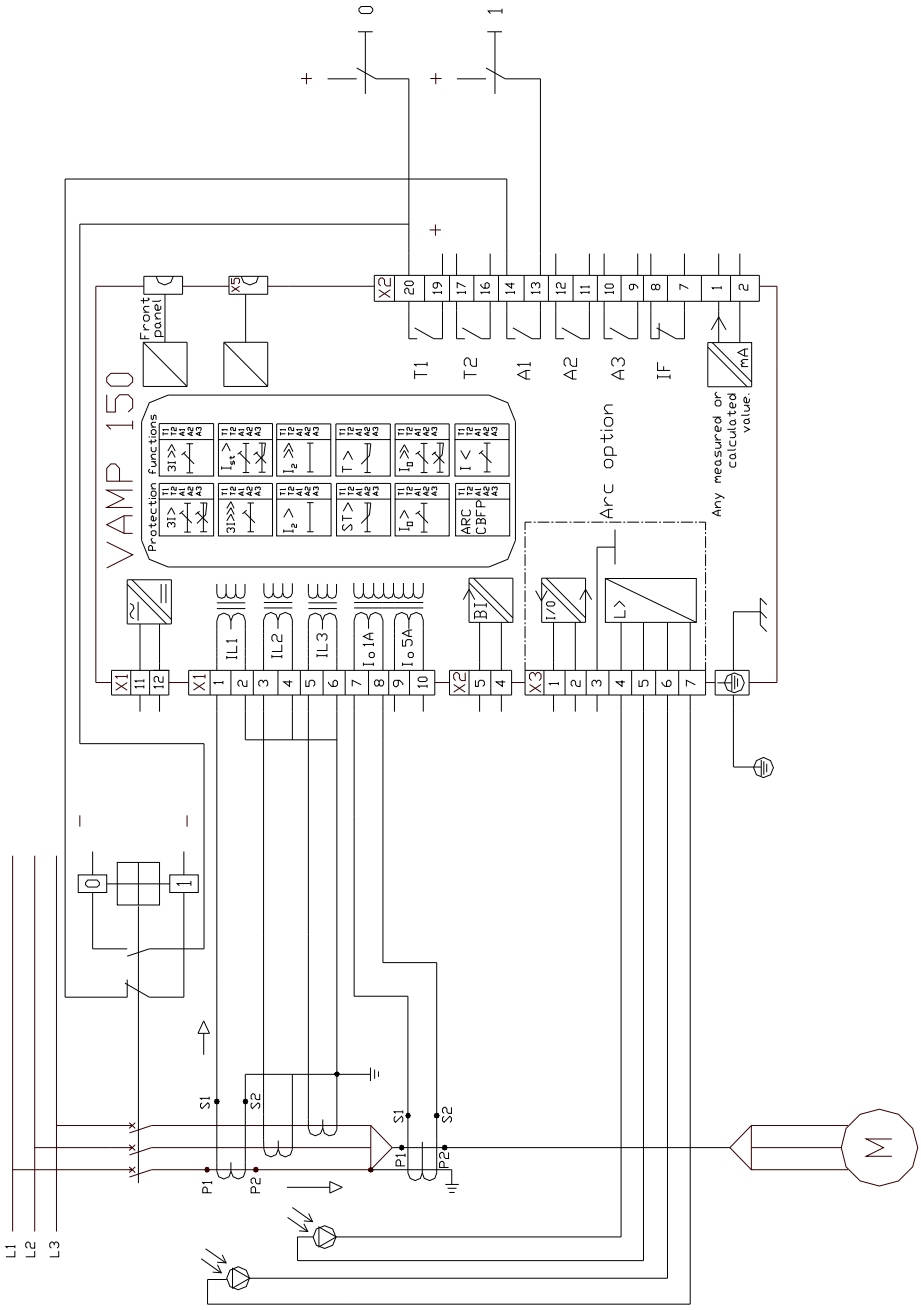


Figure 4.8-1. VAMP 150 connection diagram. Relay contact positions when no auxiliary power supply connected.

5. Technical data

5.1. Connections

5.1.1. Measuring circuitry

Rated current In	1 A or 5 A
- current measuring range	0 – 50 x In
- thermal withstand	4 x In (continuous) 20 x In (for 10 s) 100 x In (for 1 s)
- power consumption	< 0.1 VA (In = 1A) < 0.2 VA (In = 5A)
- inaccuracy I ≤ 1.5 x In I > 1.5 x In	 ±0.5% of value or ±0.3% of rated value ±3% of value
Residual current I_{0n}	1 A or 5 A
- current measuring range	0 – 50 x I_{0n}
- thermal withstand	4 x I_{0n} (continuous) 20 x I_{0n} (for 10 s) 100 x I_{0n} (for 1 s)
- power consumption	< 0.1 VA (I_{0n} = 1A) < 0.2 VA (I_{0n} = 5A)
- inaccuracy I_0 ≤ 1.5 x I_{0n} I_0 > 1.5 x I_{0n}	 ±0.5% of value or ±0.3% of rated value ±3% of value
Rated frequency fn	50/60 Hz
- frequency measuring range	16 - 65 Hz
- inaccuracy	±10 mHz

5.1.2. Auxiliary voltage

	Type A (standard)	**Type B (option)**
Rated voltage Uaux	40 - 265 V ac/dc 110/120/220/240 V ac 48/60/110/125/220 V dc	18 - 36 V dc 24 V dc
Power consumption	< 7 W (under normal conditions) < 15 W (as the relay has started)	
Max. permitted ac component of dc supply, point-to-point	<= 12% of rated voltage <= 6% near the limits of the voltage range	
Max. permitted interruption time	< 50 ms (110 V dc)	

5.1.3. Digital input

Number of inputs	1
External control voltage	18 - 265 V ac/dc
Burden	< 2 mA

5.1.4. Trip contacts (T1 and T2)

Number of contacts	2 making contacts
Rated voltage	250 V ac
Continuous carry	5 A
Max. making current	15 A
Breaking capacity, AC	2 000 W/VA
Breaking capacity, DC (L/R=40ms)	50 W
Contact material	AgNi 90/10

5.1.5. Alarm contacts (A1...A3) and IF

Number of contacts	3 making contacts (relays A1...A3) 1 making contact (relay IF)
Rated voltage	250 V ac
Continuous carry	5 A
Breaking capacity	1 500 W/VA
Contact material	AgNi 0,15 gold plated

5.1.6. Local serial communication port

Number of ports	1 on front panel
Electrical connection	RS 232
Data transfer rate	2 400…38 400 b/s

5.1.7. Remote control port

Number of ports	1 on rear panel
Electrical connection	TTL (standard) RS 485 (option) RS 232 (option) plastic fibre connection (option)
Data transfer rate	1 200...38 400 b/s
Protocols	ModBus,, RTU master ModBus,, RTU slave SPA Bus, slave Profibus DP (option) ModBus TCP (option) Transparent TCP/IP (option) IEC-6870-5-103

5.1.8. mA output

Number of outputs	1
Output signal	0/1 - 5 mA or 0/4 - 20 mA or any between 0...20mA
Load resistance	RL < 600 ΩW
Accuracy	Class 1

5.1.9. Arc option card

Binary input - operationg voltage	 +48 Vdc (optically isolated input)
Binary output - output voltage level	 +48 Vdc (transistor controlled output)
Arc sensor inputs - number of inputs - operating voltage level - current consumption passive state active state (light act.)	 2 12 Vdc (optically isolated inputs) ~ 20 mA ~ 2 mA ~ 20 mA

5.1.10. Connectors

Connector X1

Max. torque	1.2 Nm
AWG	14 - 10

Connectors X2 and X4

Max. torque	0.5 – 0.6 Nm
AWG	24 - 12

5.2. Tests and environmental conditions

5.2.1. Disturbance tests (EN 50263)

Emission - Conducted (EN 55022) - Emitted (EN 55022)	 0.15 - 30 MHz 30 - 1 000 MHz
Immunity - Static discharge (ESD) - Fast transients (EFT) - Surge - Conducted RF field - Emitted RF field - GSM test	 EN 61000-4-2, class III 6 kV contact discharge 8 kV air discharge EN 61000-4-4, class III 2 kV, 5/50 ns, 5 kHz, +/- EN 61000-4-5, class III 1 kV, 1.2/50 µs, common mode 2 kV, 1.2/50 µs, differential mode EN 61000-4-6 0.15 - 80 MHz, 10 V/m, 80% AM (1 kHz) EN 61000-4-3 80 - 1000 MHz, 10 V/m, 80% AM (1 kHz) EN 61000-4-3 900 MHz, 10 V/m, pulse modulated
1 MHz burst	IEC 60255-22-1 1 kV, differential mode 2,5 kV, common mode
Voltage interruption	IEC 60255-11

5.2.2. Test voltages

Insulation test voltage (IEC 60255-5)	2 kV, 50 Hz, 1 min
Surge voltage (IEC 60255-5)	5 kV, 1,2/50 µs, 0,5 J

5.2.3. Mechanical tests

Vibration (IEC 60255-21-1)	10 - 60 Hz, amplitude ±0.035 mm 60 - 150 Hz, acceleration 0.5g sweep rate 1 octave/min 20 periods in X-, Y- and Z axis direction
Shock (IEC 60255-21-1)	half sine, acceleration 5 g, duration 11 ms 3 shocks in X-, Y- and Z axis direction

5.2.4. Environmental conditions

Operating temperature	-10 to +55 ×C
Transport and storage temperature	-40 to +70 ×C
Relative humidity	< 75% (1 year, average value) < 90% (30 days per year, no condensation permitted)

5.2.5. Casing

Degree of protection (IEC 60529)	IP20
Dimensions (W x H x D)	99 x 155 x 225 mm
Weight	2.3 kg

5.3. Protection stages

5.3.1. Overcurrent protection

Overcurrent stage I> (50/51)

Current setting range:	0.10 – 10.00 xI_{MOT} (step 0.01)
Definite time characteristic:	
- operating time	0.06** - 300.00 s (step 0.02)
Inverse time characteristic:	
- 4 characteristic curve sets: (IEC60255-3)	EI, VI, NI, LTI *)
- Time multiplier k	0.05 – 3.20 (step 0.01)
Starting time	<60 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±2% of set value
- operating time definite time	±1% or ±30 ms
- operating time inverse time	±5% or at least ±30 ms (I< 50 x In)

*) EI = Extremely Inverse, VI = Very Inverse, NI = Normal inverse, LTI = Long Time Inverse

**) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

Overcurrent stages I>> and I>>> (50/51)

Current setting range:	0.10 – 20.00 xI_{MOT} (step 0.01)
Definite time characteristic:	
- operating time	0.05* - 300.00 s (step 0.01)
Starting time	<30 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±2% of set value
- operate time	±1% or ±30 ms

*) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

Stall protection stage (48)

Setting range:	
- Ist>	1.30 – 10.00 xI_{MOT} (step 0.01)
- I_{MOT}St	1.50 – 10.00 xI_{MOT} (step 0.01)
Definite time characteristic:	
- operating time	1.0 - 300.0 s (step 0.1)
Inverse time characteristic:	
- 1 characteristic curve	Inv
- Time multiplier tDT>	1.0 – 200.0 s (step 0.1)
Starting time	<300 ms
Resetting time	<300 ms
Resetting ratio	0.90
Accuracy:	
- operating time	±5% or at ±80 ms

Thermal overload stage T> (49)

Setting range:	0.5 – 1.20 xI_{MOT} (step 0.01)
Alarm setting range:	60 – 99 % (step 1%)
Time constant Tau:	2 – 60 min (step 1)
Cooling time constant Tau2:	1.0 – 5.0 xTau (step 0.1)
Max. overload at +40 °C	70 – 120 %I_{MOT} (step 1)
Max. overload at +70 °C	50 – 100 %I_{MOT} (step 1)
Ambient temperature	-55 – 125 °C (step 1°)
Starting time	<300 ms
Resetting time	<300 ms
Resetting ratio	0.95
Accuracy:	
- operating time	±5% or at ±1 s

Unbalance stage I2> (46)

Setting range:	10 – 70% (step 1%)
Definite time characteristic:	
- operating time	1.0 – 600.0s s (step 0.1)
Inverse time characteristic:	
- 1 characteristic curve	Inv
- time multiplier	1 – 50 s (step 1)
Starting time	<40 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±3% of set value or ±5% or ±100 ms of rated value
- operate time	±1% or ±100 ms

Incorrect phase sequence I2>> (46)

Setting:	80 % (fixed)
Operating time	<120 ms

Undercurrent protection stage I< (37)

Current setting range:	20 – 70 %I_{MOT} (step 1%)
Definite time characteristic:	
- operating time	0.3 – 300.0s s (step 0.1)
Block limit:	15 % (fixed)
Starting time	<300 ms
Resetting time	<300 ms
Resetting ratio	1.05
Accuracy:	
- starting	±2% of set value
- operating time	±1% or ±200 ms

5.3.2. Residual current protection

Residual current stage I_0> (50/51N)

Residual current setting range	0.005 - 2.000 pu (step 0.005)
Definite time characteristic:	
- operating time	0.08* - 300.00 s (step 0.02 s)
Starting time	<60 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±2% of set value or ±0.3% of rated value
- operate time	±1% or ±30 ms

*) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

Residual current stage I_0>> (50/51N)

Current setting range:	0.02 – 2.00 pu (step 0.01)
Definite time characteristic:	
- operating time	0.05** - 300.00 s (step 0.01)
Inverse time characteristic:	
- 4 characteristic curve sets: (IEC60255-3)	EI, VI, NI, LTI *)
- Time multiplier k	0.05 – 3.20 (step 0.01)
Starting time	<60 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±2% of set value or ±0.3% of rated value
- operating time definite time	±1% or ±30 ms
- operating time inverse time	±5% or at least ±30 ms (I_0 < 5 x I_{0n})

*) EI = Extremely Inverse, VI = Very Inverse, NI = Normal inverse, LTI = Long Time Inverse

**) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

5.3.3. Frequent start protection

Frequent start protection stage N> (66)

Setting range:	1 – 20
Interval:	0.0 – 100.0 min (step 0.1 min = 6 s)
Accuracy	
- time	±0.1% or ±500 ms

5.3.4. Arc protection (option)

The operation of the arc protection depends on the setting value of the ArcI> current limit. The current limit cannot be set, unless the relay is provided with the optional arc protection card.

Arc protection stage ArcI> (51L>)

Current setting range	0.5 – 10.0 pu (step 0.1 pu)
Operating time	~ 15 ms
Arc sensor channel selection	S1, S2, BI, S1/S2, S1/BI, S2/BI, S1/S2/BI

The operation of the earth-fault arc protection depends on the setting value of the ArcIo> earth-fault limit. The earth-fault limit cannot be set, unless the relay is provided with the optional arc protection card.

Arc protection stage Arc I_0> (51NL>)

Current setting range	0.05 – 10.0 pu (step 0.1 pu)
Operating time	~ 15 ms
Arc sensor channel selection	S1, S2, BI, S1/S2, S1/BI, S2/BI, S1/S2/BI

5.4. Disturbance Recorder (DR)

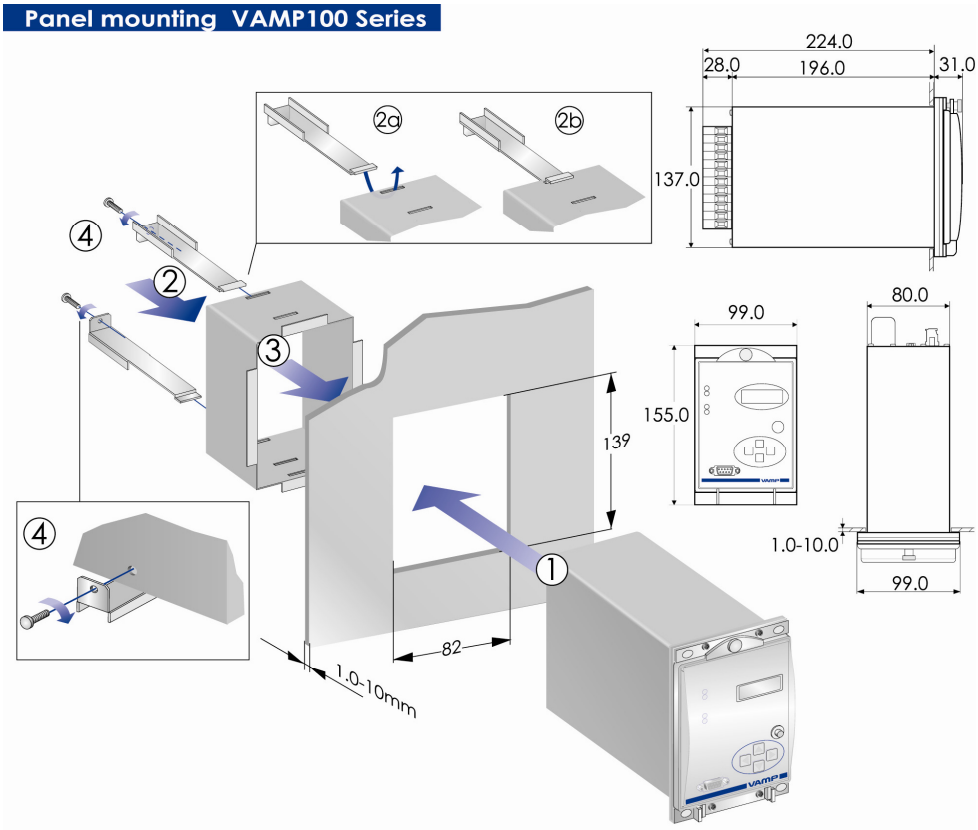
The operation of Disturbance recorder depends on the following settings. The recording time and number of records depend on the time setting and number of selected channels.

Disturbance recorder (DR)

Mode of recording:	Saturated / Overflow
Sample rate:	
- waveform recording	16/cycle, 8/cycle
- trend curve recording	10, 20, 200 ms
	1, 5, 10, 15, 30 s
	1 min
Recording time (one record)	0.1 s – 12 000 min
	(must be shorter than MAX time)
Pre trigger rate	0 – 100%
Number of selected channels	0 – 12

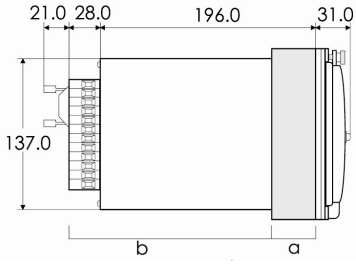
6. Dimensional drawing

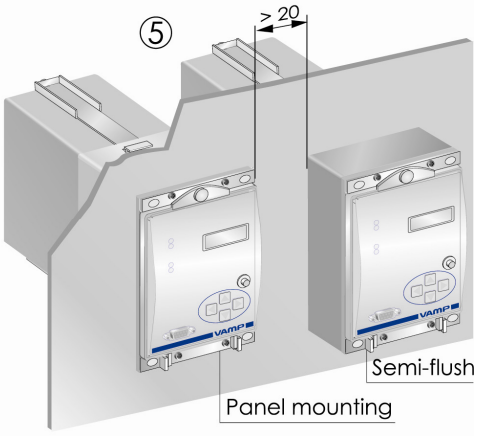
Panel mounting VAMP100 Series



Semi-flush VAMP100 Series

	a mm	b mm	Fixing bracket
VYX078	40	184	Standard for 100 series
VYX079	60	164	Standard for 100 series
VYX232	100	124	2 x VYX199

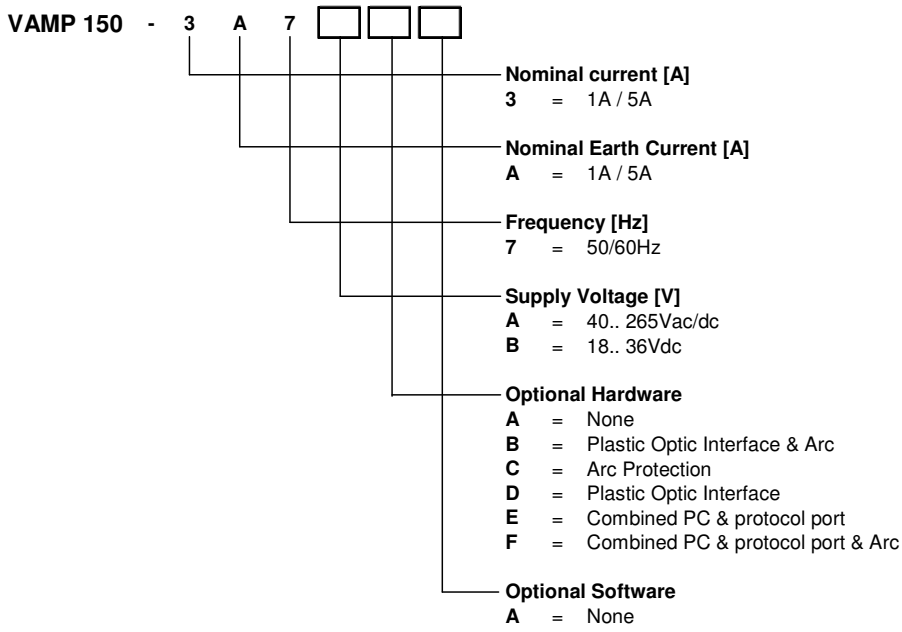




7. Order information

When asking for quotations or when ordering, please, state:
The ordering code:
Quantity:
Auxiliary voltage:
Options:

VAMP 150 ORDERING CODE


VAMP 150 - 3 A 7 □ □ □
Nominal current [A]
3 = 1A / 5A
Nominal Earth Current [A]
A = 1A / 5A
Frequency [Hz]
7 = 50/60Hz
Supply Voltage [V]
A = 40.. 265Vac/dc
B = 18.. 36Vdc
Optional Hardware
A = None
B = Plastic Optic Interface & Arc
C = Arc Protection
D = Plastic Optic Interface
E = Combined PC & protocol port
F = Combined PC & protocol port & Arc
Optional Software
A = None

Accessories :

Order Code	Explanation	Note
VEA 3 CG	External Ethernet Interface Module	VAMP Ltd
VPA 3 CG	Profibus Interface Module	VAMP Ltd
VSE001	Fiber optic Interface Module	VAMP Ltd
VSE002	RS485 Interface Module	VAMP Ltd
VX003-3	Programming Cable (VAMPSet, VEA 3 CG+200serie)	Cable length 3m
VX004-M3	TTL/RS232 Converter Cable (for PLC, VEA3CG+200serie)	Cable length 3m
VX007-F3	TTL/RS232 Converter Cable (for VPA 3 CG or VMA 3 CG)	Cable length 3m
VX015-3	TTL/RS232 Converter Cable (for 100serie+VEA3CG)	Cable length 3m
VX008-4	TTL/RS232 Converter Cable (for Modem MD42, ILPH, ..)	Cable length 4m
VA 1 DA-6	Arc Sensor	Cable length 6m
VYX078	Raising Frame for 100-serie	Height 40mm
VYX079	Raising Frame for 100-serie	Height 60mm

8. Reference Information

Technical documentation:
Mounting and Commissioning Instructions VMMC.EN0xx
VAMPSET Operating Instructions VMV.EN0xx

Manufacturer / Service :
VAMP Ltd
P.O. Box 810
FIN-65101 Vaasa, Finland
Street address: Yrittäjänkatu 15
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